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Table 1: Range of Cigarette Design Parameters

Cigarette Features	Number / Type	Ranges
Brands	15 Brand Families	48 Brand Styles
Regions (1)	6	USA, Latin America, Asia Pacific, Japan, EU, CEMA
ISO "Tar"		1 - 14 mg/cig
Filter Types (2)	6	Cellulose acetate (CA), CA/carbon (three types), Concentric paper
Filter Ventilation		0 - 80%
Cigarette Length	7	68 - 100 mm
Cigarette Circumference	2	Slim (~ 23 mm) and Standard (~ 25 mm)
Cigarette Paper Permeability (3)		9 - 87 CORESTA Units
Menthol Flavoring	2	5 menthol, 44 non-menthol
Tobacco Weight		0.49 - 0.89 g/cig
Tobacco Blend	2	Approximately 100% Virginia (bright) or Blends of bright, burley, Oriental tobaccos
Packaging	2	41 Hard Pack, 7 Soft Pack

(1) EU = European Union, CEMA = Central Europe, Middle East, Africa

(2) CA = cellulose acetate, CA/Carbon is a filter containing both a CA section and a section with carbon on CA

(3) CORESTA Unit (CU) = air flow, cc/min, passing through a 1 cm^2 test apparatus surface at 1.0 kPa pressure

Table 2: Health Canada Test Methods for Mainstream Smoke and Whole Tobacco

Mainstream Smoke Constituents	Health Canada Official Methods
"tar", nicotine, carbon monoxide	T-115
Carbonyls formaldehyde, acetaldehyde, methyl ethyl ketone (MEK), acetone, propionaldehyde, acrolein, crotonaldehyde, butyraldehyde	T-104
Volatile Organics 1,3-butadiene, isoprene, acrylonitrile, benzene, toluene	T-116
Phenolics hydroquinone, resorcinol, phenol, catechol, o-cresol, m & p-cresols	T-114
Aromatic Amines 1- and 2-aminonaphthalene, 3- and 4-aminobiphenyl	T-102
nitric oxide (NO), total oxides of nitrogen (NOx)	T-110
hydrogen cyanide	T-107
ammonia	T-101
benzo[a]pyrene	T-103
pyridine, quinoline, styrene	T-112
Tobacco Specific Nitrosamines N-nitrosonornicotine (NNN), 4-(N-methyl-N-nitrosamino)-1-(3-pyridyl)-1-butanone (NNK), N-nitrosoanatabine (NAT), N-nitrosanabasine (NAB)	T-111
Mercury	T-108
Metals cadmium, lead, chromium, nickel, arsenic, selenium	T-109
pH	T-113
Whole Tobacco Constituents	
Nitrate	T-308
Tobacco Specific Nitrosamines N-nitrosonornicotine (NNN), 4-(N-methyl-N-nitrosamino)-1-(3-pyridyl)-1-butanone (NNK), N-nitrosoanatabine (NAT), N-nitrosanabasine (NAB)	T-309

Table 3: Averaged ISO Mainstream Smoke Constituent Yields

Sample Code	Brand / Region (1)	"tar" (mg/cig)		nicotine (mg/cig)		carbon monoxide (mg/cig)		acetaldehyde (ug/cig)		acetone (ug/cig)		acrolein (ug/cig)		butyraldehyde (ug/cig)		crotonaldehyde (ug/cig)		methyl ethyl ketone (ug/cig)		propionaldeyde (ug/cig)	
	Exploratory Brand Set	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
E1	L & M King F HP / EU	12.6	0.6	0.81	0.03	11.5	0.5	598	5	330	12	57.6	3.0	40.8	2.1	23.3	0.9	74.5	3.7	59.3	2.8
E2	Merit King F HP / EU	7.04	0.41	0.54	0.03	8.12	0.49	384	20	224	6	35.8	2.1	25.8	1.5	10.0	1.1	46.1	1.9	36.4	2.7
E3	Marlboro King F HP (Norway) / EU	13.2	0.7	0.93	0.05	11.3	0.8	540	85	287	34	51.0	7.7	33.9	5.2	19.5	3.2	65.6	8.9	50.2	7.1
E4	Chesterfield INTL King F HP Ultra-Lt / EU	3.39	0.23	0.30	0.01	3.40	0.18	148	10	106	5	12.5	0.9	11.4	0.7	NQ	NQ	17.6	0.9	14.9	1.3
E5	Parliament 100 F SP / CEMA	10.2	0.4	0.77	0.04	10.2	0.5	409	41	201	29	31.4	5.9	20.9	3.0	6.56	1.31	31.8	5.8	33.6	5.0
E6	Philip Morris One King F HP / EU	1.55	0.22	0.16	0.01	1.99	0.16	75.7	12.1	65.0	7.5	5.38	1.10	6.16	1.13	NQ	NQ	7.99	1.51	7.07	0.91
E7	Marlboro Long Size F HP (Argentina) / Latin America	13.9	0.5	1.00	0.04	13.4	0.6	626	36	344	13	61.9	3.6	40.3	1.8	24.9	1.6	76.4	4.7	59.5	1.9
E8	Parliament King F HP Lt (Japan) / US Export	6.99	0.35	0.57	0.03	7.46	0.29	216	41	117	24	14.8	2.7	11.0	1.8	NQ	NQ	16.6	3.7	15.8	3.3
E9	L & M King F HP Lt / EU	8.35	0.42	0.58	0.03	8.42	0.34	397	21	220	8	35.6	1.9	26.0	1.8	10.9	0.9	45.1	1.9	36.1	1.9
E10	Marlboro Long Size F HP (Venezuela) / Latin America	13.1	0.8	0.91	0.05	11.1	0.7	504	68	276	33	45.7	6.0	32.2	3.8	17.8	3.5	59.3	7.6	48.2	5.5
E11	Marlboro King F HP (Taiwan) / US Export	11.6	0.9	0.93	0.04	9.63	0.63	384	46	203	22	32.1	3.8	21.9	2.8	7.97	1.40	37.2	5.0	33.3	3.3
E12	F6 King F HP Lt / EU	8.37	0.37	0.71	0.04	8.58	0.43	363	53	209	20	33.0	5.3	25.3	2.9	10.1	1.6	46.2	4.7	34.1	3.5
E13	Virginia Slims 100 F HP Menthol 1mg (Japan) / US Export	0.884	0.146	0.10	0.01	1.14	0.10	32.4	11.9	46.5	6.1	NQ	NQ	NQ	NQ	BDL	BDL	NQ	NQ	NQ	NQ
E14	Marlboro King F HP Lt (Germany+Great Britain) / EU	5.94	0.26	0.53	0.03	6.38	0.24	323	43	182	13	30.1	4.2	21.4	2.6	6.98	1.13	36.3	3.6	30.7	3.5
E15	Virginia Slims 100 F HP Ultra-Lt Menthol (Japan) / US Export	2.75	0.24	0.23	0.02	3.12	0.30	114	25	96.4	17.4	8.71	2.14	8.80	1.83	NQ	NQ	13.3	3.0	11.0	2.0
E16	Parliament 100 F SP Lt / US	11.6	0.6	0.95	0.05	11.4	0.6	481	29	239	10	38.6	2.8	26.1	1.8	8.76	0.90	44.0	2.6	41.0	3.4
E17	Marlboro King F SP / US	14.2	0.5	1.02	0.04	12.9	0.6	601	43	318	12	55.4	5.8	39.7	3.6	20.1	2.4	71.7	6.3	55.7	4.6
E18	Marlboro 100 F HP / EU	12.6	0.5	0.93	0.04	11.6	0.6	554	33	291	18	51.3	3.4	35.8	2.6	17.4	1.4	67.3	5.1	51.5	3.0
E19	Marlboro 100 F HP Lt (Germany) / EU	6.92	0.23	0.63	0.02	7.05	0.43	311	39	178	14	27.5	4.7	19.5	2.3	5.98	1.09	34.4	3.5	28.6	3.4
E20	SG Ventil Regular F SP / EU	11.1	0.5	0.67	0.03	9.15	0.44	488	45	267	22	44.3	4.7	33.7	2.3	20.5	1.8	61.8	4.6	47.0	4.5
E21	Muratti King F HP Ultra-Lt 1mg / CEMA	0.972	0.184	0.11	0.01	1.27	0.08	57.2	11.1	59.3	8.5	3.58	0.67	5.44	0.81	NQ	NQ	6.61	0.84	5.69	0.63
E22	Diana King F SP Specially Mild / EU	9.65	0.34	0.74	0.03	8.78	0.28	390	63	223	26	39.1	8.1	27.7	4.5	13.9	2.4	48.7	7.2	39.2	5.6
E23	Muratti Ambassedor King F HP / EU	8.38	0.40	0.65	0.05	7.49	0.37	288	43	146	22	19.7	3.7	15.4	1.9	4.92	0.93	24.7	4.0	23.6	3.4
E24	Merit King F SP Ultra-Lt (PaperSelect) / US	4.92	0.22	0.46	0.03	5.91	0.25	254	50	165	28	20.4	4.7	19.5	3.9	5.82	1.65	31.1	6.1	25.0	4.6
E25	Petra Regular F HP / CEMA	13.3	0.6	0.85	0.03	11.2	0.4	515	71	287	34	43.8	6.1	37.6	4.3	20.7	3.5	69.7	9.0	49.2	6.4
E26	Marlboro King F HP Ultra-Lt Menthol / US	5.86	0.47	0.49	0.04	6.92	0.40	277	48	170	25	25.7	4.0	20.5	3.8	6.71	1.56	33.0	5.4	26.9	3.5
E27	Diana King F HP Ultra-Lt / EU	3.03	0.16	0.29	0.02	3.32	0.24	146	16	103	12	13.0	2.0	10.9	1.2	NQ	NQ	16.6	2.0	14.6	1.8
E28	Marlboro King F HP (Malaysia) / Asia Pacific	14.4	0.5	1.03	0.04	11.9	0.7	604	28	316	19	58.7	3.5	43.8	3.5	23.3	2.1	69.2	5.1	60.4	3.5
E29	Marlboro King F HP 25's (Australia) / US Export	13.1	0.6	0.98	0.05	12.3	0.9	517	45	291	29	47.4	3.6	36.2	4.5	17.6	2.7	62.6	6.9	49.7	3.8
E30	Marlboro King F HP (Japan) / Japan	12.1	0.5	1.04	0.05	11.2	0.6	481	31	257	14	38.6	2.8	23.9	2.2	9.17	1.12	46.2	3.9	39.5	2.6
E31	Longbeach One King F HP / Australia	1.22	0.14	0.15	0.02	1.64	0.14	113	19	95.8	7.0	8.71	1.49	8.18	0.97	NQ	NQ	15.0	2.4	11.1	1.7
E32	Chesterfield Originals King F HP Lt / EU	7.98	0.45	0.59	0.02	8.35	0.43	432	42	243	19	41.3	3.1	27.0	2.5	12.4	1.1	51.7	5.1	40.4	3.0
E33	Philip Morris 100 F HP Super Lights / EU	3.31	0.29	0.33	0.02	3.53	0.19	161	11	115	10	13.0	1.0	12.2	0.7	NQ	NQ	19.4	2.2	14.9	1.2
E34	Chesterfield Originals King F HP / EU	11.9	0.5	0.80	0.04	11.7	0.7	588	36	319	19	57.0	3.7	36.8	2.6	22.6	2.3	74.7	5.9	53.5	4.2
E35	Marlboro King F HP Medium / EU	9.62	0.39	0.72	0.03	10.0	0.7	458	36	262	15	41.2	2.6	29.2	1.4	13.5	0.9	57.9	3.5	42.9	3.8
E36	Virginia Slims 100 F HP Ultra-Lt Menthol / US	5.13	0.29	0.45	0.02	4.90	0.33	207	34	139	17	20.5	3.7	14.4	1.8	4.61	1.01	24.6	3.9	20.0	2.4
E37	Marlboro King F HP Ultra-Lt / EU	3.04	0.22	0.29	0.01	3.49	0.12	150	5	105	7	11.8	1.0	10.4	0.7	NQ	NQ	16.5	0.9	14.0	1.1
E38	L & M King F HP (Malaysia) / Asia Pacific	13.5	0.4	1.01	0.03	10.4	0.3	591	53	292	15	57.2	6.3	39.3	3.5	21.8	2.4	64.3	4.6	54.6	4.7
E39	Marlboro King F HP Lt (Japan) / Japan	5.87	0.26	0.44	0.02	6.77	0.40	227	22	126	13	16.7	2.2	11.0	1.0	NQ	NQ	17.6	2.3	18.2	2.5
	Validation Brand Set																				
V1	Marlboro King F HP Lt (Norway) / EU	8.34	0.41	0.69	0.04	8.53	0.38	383	41	201	17	30.8	4.6	24.7	3.7	10.9	1.7	41.8	4.2	32.8	3.9
V2	Raffles 100 F HP / EU	12.3	0.5	1.19	0.10	12.8	0.7	643	40	335	18	60.3	4.5	47.5	3.3	28.3	2.9	78.0	6.1	56.4	3.3
V3	Chesterfield King F HP Lt / EU	6.25	0.23	0.54	0.04	7.27	0.34	319	17	176	10	27.6	1.5	20.9	1.5	8.86	1.10	34.5	2.8	28.1	1.7
V4	Philip Morris King F HP Super Lights / EU	4.13	0.39	0.40	0.03	4.05	0.31	147	16	96.5	8.8	12.1	1.6	11.4	1.2	NQ	NQ	15.9	1.7	13.8	1.6
V5	Merit King F SP Ultima (PaperSelect) / US	1.32	0.23	0.13	0.01	2.43	0.14	129	13	86.8	5.4	9.75	0.81	10.2	1.8	NQ	NQ	13.4	1.1	11.8	1.1
V6	Marlboro 100 F HP Lt / US	9.58	0.40	0.80	0.05	10.7	0.3	461	61	262	30	42.8	6.4	33.1	4.2	15.8	2.6	53.9	6.1	42.6	4.5
V7	Peter Jackson King F HP Menthol / Australia	7.40	0.37	0.72	0.06	8.34	0.39	396	31	224	15	39.9	3.2	27.0	1.8	16.5	1.9	48.4	3.5	35.4	2.6
V8	Marlboro King F HP (Mexico) / Latin America	13.2	0.5	1.13	0.06	12.1	0.5	520	49	298	26	50.7	5.3	35.7	3.2	22.8	2.8	62.8	6.4	47.8	4.3
V9	Marlboro King F HP (Brazil) / Latin America	12.1	0.7	0.97	0.09	11.4	0.5	527	64	288	25	47.7	6.4	36.9	4.7	22.8	3.0	64.2	5.4	48.0	5.4
	Reference Cigarettes																				
R1	1R4F Kentucky Reference	9.14	0.36	0.73	0.04	11.6	0.6	574	57	312	22	46.3	4.8	38.8	3.6	14.9	1.5	75.0	6.4	55.9	5.6
R2	1R4F Kentucky Reference	8.92	0.38	0.77	0.07	12.2	0.5	516	43	282	21	38.5	3.4	36.1	5.5	15.4	1.5	63.8	5.4	48.1	3.8

(1) Brand names are trademarks of Philip Morris, Inc., Philip Morris Products S.A., Philip Morris Limited (Australia), Philip Morris CR. A.S., Tabaqueria, S.A., or F6 Cigarettenfabrik Dresden GmbH, De.

(2) N-nitrosonornicotine (NNN), 4-(N-methyl-N-nitrosamino)-1-(3-pyridyl)-1-butanone (NNK), N-nitrosoanatabine (NAT), N-nitrosoanabasine (NAB)

(3) BDL = below the detection limit, NQ = below the limit for quantitation

Table 3: Averaged ISO Mainstream Smoke Constituent Yields

Sample Code	formaldehyde (ug/cig)		acrylonitrile (ug/cig)		benzene (ug/cig)		1,3-butadiene (ug/cig)		isoprene (ug/cig)		styrene (ug/cig)		toluene (ug/cig)		ammonia (ug/cig)		hydrogen cyanide (ug/cig)		nitric oxide (ug/cig)		nitrogen oxides (ug/cig)		1-aminonaphthalene (ng/cig)		2-aminonaphthalene (ng/cig)	
	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
E1	42.8	2.4	10.1	0.7	44.6	2.6	45.5	3.4	356	18	10.5	0.7	69.9	5.3	17.5	1.3	117	7	153	11	155	10	17.5	3.1	10.7	1.6
E2	20.9	3.4	6.92	0.49	32.8	1.4	35.4	1.7	295	13	5.24	0.31	48.7	2.7	11.2	1.0	61.6	4.5	141	14	145	17	11.6	1.0	7.61	0.72
E3	38.2	7.6	10.7	0.4	43.6	1.5	45.7	2.9	385	21	9.31	0.56	67.6	2.9	17.8	1.5	114	6	156	16	158	16	18.2	2.1	11.1	1.2
E4	6.73	2.07	2.77	0.27	17.5	0.7	17.9	1.4	150	11	2.51	0.26	24.2	1.8	5.64	0.47	13.4	2.0	59.1	4.9	60.7	5.3	7.76	1.15	4.74	0.72
E5	23.3	2.9	5.78	0.45	23.2	1.9	39.0	1.9	286	23	2.68	0.19	28.7	2.6	17.8	1.5	58.5	6.8	184	18	186	18	19.8	2.8	11.9	1.7
E6	3.43	0.67	1.82	0.15	11.0	0.9	12.8	1.4	130	12	1.38	0.14	13.9	1.6	4.40	0.47	6.80	0.77	67.0	7.9	68.7	8.3	5.86	0.70	3.72	0.42
E7	52.1	5.2	11.3	0.7	44.1	2.1	48.5	2.8	475	34	10.2	0.7	66.0	2.6	16.2	1.8	132	4	177	11	182	11	15.7	2.6	9.86	1.64
E8	10.8	1.2	3.58	0.38	15.1	1.3	23.9	0.8	195	10	1.85	0.30	20.5	1.4	12.7	1.1	28.7	2.9	161	14	162	14	14.8	1.2	9.45	0.53
E9	24.8	4.8	7.04	0.29	34.7	1.3	34.6	1.4	271	11	5.88	0.61	52.3	2.4	11.5	1.7	58.3	4.5	115	15	117	16	13.8	2.1	8.63	1.22
E10	35.2	4.5	9.80	0.27	37.7	1.2	43.8	2.1	414	20	7.75	0.37	56.9	4.1	19.7	1.9	113	6	148	11	151	12	20.4	2.6	12.1	1.2
E11	24.1	5.9	5.89	0.42	26.6	1.8	36.4	0.7	313	17	3.37	0.39	37.2	3.2	22.2	0.9	99.5	7.1	231	26	239	26	21.4	2.3	13.4	1.7
E12	31.2	5.3	4.89	0.26	35.0	2.6	35.4	3.0	276	18	5.05	0.34	49.5	6.1	10.0	0.7	73.2	5.3	57.5	9.9	59.9	10.4	10.7	2.2	6.52	1.02
E13	1.61	0.61	NQ	NQ	6.31	0.53	6.40	0.23	74.4	3.0	NQ	NQ	NQ	NQ	3.18	0.28	3.40	0.47	31.0	3.2	31.9	3.1	3.21	0.52	2.25	0.33
E14	22.1	6.7	3.71	0.29	25.9	1.1	30.8	1.6	270	16	3.37	0.30	35.6	3.0	9.27	0.59	45.6	4.4	78.1	16.0	80.9	14.8	10.7	0.8	6.88	0.70
E15	3.49	1.04	1.68	0.13	16.0	1.5	16.1	1.8	164	8	1.25	0.17	21.5	3.2	6.31	0.48	15.4	1.7	80.5	13.5	83.1	14.2	8.85	1.66	5.61	0.78
E16	29.9	6.7	5.32	0.34	26.2	1.9	37.7	1.4	330	15	2.67	0.38	35.0	4.2	22.2	1.3	107	8	223	16	231	15	21.5	2.2	13.5	1.6
E17	38.0	8.6	10.0	0.8	45.2	3.1	50.8	3.1	484	31	8.83	0.73	68.8	5.5	25.9	0.6	194	13	242	14	254	15	22.5	4.1	13.8	2.1
E18	36.6	8.8	8.73	0.74	43.8	3.4	45.9	1.2	411	17	7.29	0.46	66.0	5.6	21.7	0.7	120	13	153	14	159	14	22.4	3.8	13.3	1.0
E19	13.5	3.0	4.82	0.60	30.2	2.5	31.9	1.8	299	17	3.72	0.42	41.2	4.9	10.4	0.2	51.0	2.9	86.8	8.8	89.9	9.6	14.9	2.2	8.86	1.55
E20	41.7	5.3	8.19	0.65	31.8	2.2	35.2	2.9	281	15	9.42	0.84	47.0	3.6	12.7	1.2	107	7	81.1	10.8	84.9	11.2	13.7	2.4	8.46	0.79
E21	2.18	0.28	NQ	NQ	6.07	0.46	6.59	0.44	70.1	2.6	0.856	0.395	NQ	NQ	3.07	0.33	4.25	0.99	27.7	5.0	28.9	5.1	5.41	0.77	3.39	0.46
E22	24.3	4.8	8.33	0.54	37.8	2.2	36.8	2.4	313	21	8.65	0.55	55.2	3.3	12.9	1.3	99.5	7.1	101	9	104	10	15.2	2.9	10.2	1.7
E23	18.9	2.0	3.56	0.20	17.6	0.6	25.0	0.9	182	8	2.73	1.06	24.2	1.6	11.7	1.1	42.7	3.9	54.7	3.0	57.0	2.9	16.6	3.6	10.0	1.5
E24	8.54	1.29	4.39	0.28	23.0	1.2	23.0	1.4	233	16	4.01	0.49	30.7	3.3	8.79	0.86	51.4	5.6	115	17	119	19	14.4	2.5	9.25	1.01
E25	41.8	7.9	9.49	0.53	40.0	2.6	38.5	1.5	307	10	11.6	0.5	62.8	5.3	17.2	1.0	126	10	86.0	6.8	88.9	6.9	15.8	2.0	10.7	1.4
E26	9.72	1.65	5.36	0.25	28.2	1.2	28.2	1.6	270	13	3.74	0.68	37.5	2.0	10.9	0.6	84.2	3.2	137	8	142	8	16.0	3.3	10.5	1.4
E27	5.95	0.85	2.31	0.28	15.4	1.3	14.9	0.9	136	6	2.11	0.32	19.1	2.2	5.29	0.59	15.2	1.6	37.8	5.0	39.5	5.0	8.88	1.25	5.82	0.90
E28	28.1	2.4	11.7	1.2	44.1	4.5	43.9	2.2	403	30	11.6	1.2	65.6	7.9	29.0	1.1	185	9	216	23	226	24	27.0	3.2	17.2	0.9
E29	26.2	0.8	10.5	0.7	42.3	2.4	43.3	2.8	439	20	9.40	0.78	63.1	4.3	23.3	0.6	167	11	191	26	201	27	23.4	3.4	15.2	2.2
E30	29.4	2.0	6.14	0.40	24.5	1.4	36.1	1.3	278	13	4.26	0.57	34.2	2.8	16.8	0.7	77.5	8.6	170	16	179	20	23.8	3.0	15.3	1.4
E31	3.52	0.62	1.25	0.14	11.2	0.6	11.3	0.7	93.6	6.5	1.66	0.46	14.5	1.6	NQ	NQ	5.92	0.72	13.2	1.8	13.2	2.6	4.43	0.71	2.90	0.41
E32	21.2	2.5	6.46	0.32	29.7	1.3	33.2	0.5	272	8	4.60	0.67	44.7	2.3	12.0	0.4	62.1	5.0	91.2	11.2	95.9	12.2	14.8	1.1	10.1	0.4
E33	6.23	1.06	2.61	0.21	16.7	0.9	17.2	0.5	158	5	2.47	0.42	22.7	2.9	6.31	0.23	16.2	1.6	59.9	11.4	62.3	12.1	11.2	0.7	7.80	0.43
E34	33.2	2.5	9.87	0.49	37.6	2.1	42.9	2.9	357	10	9.58	0.79	58.0	4.0	16.8	0.9	130	10	118	9	123	10	16.9	1.4	10.8	1.0
E35	26.7	1.1	6.88	0.36	33.0	1.8	34.4	1.0	284	6	6.22	0.57	50.5	2.8	13.9	0.9	90.4	8.2	123	12	130	13	16.7	1.4	11.8	1.0
E36	9.10	1.44	3.71	0.39	19.7	1.0	21.2	1.2	199	12	2.90	0.38	28.5	2.0	10.2	0.9	35.3	5.8	111	15	114	15	14.0	1.7	9.65	1.18
E37	5.50	0.60	2.16	0.09	14.7	0.6	16.1	0.9	150	6	2.13	0.47	19.4	0.7	5.35	0.49	13.6	1.1	42.3	3.0	43.9	3.1	9.15	0.50	5.26	0.31
E38	33.5	4.8	10.5	0.4	38.5	1.5	43.2	1.9	412	15	9.91	0.87	61.8	2.4	20.4	0.9	151	12	179	18	186	18	25.8	3.9	16.7	1.5
E39	14.1	2.1	2.44	0.16	12.8	0.9	20.7	1.0	132	7	1.88	0.47	18.1	1.3	8.93	0.44	23.7	3.1	86.6	18.0	90.5	16.5	11.7	1.2	7.49	1.07
V1	19.0	3.5	7.43	0.61	30.7	1.9	35.0	2.1	291	10	5.91	0.62	47.8	3.6	14.0	1.0	68.3	3.7	106	10	113	10	15.6	1.3	9.80	1.09
V2	40.6	6.7	11.1	0.8	44.4	2.8	54.1	5.6	466	43	10.4	1.4	67.5	3.3	12.4	1.2	135	12	118	14	126	13	18.1	3.2	9.61	1.32
V3	17.3	1.9	5.50	0.24	25.4	1.5	29.3	2.6	244	21	4.56	0.68	38.2	2.5	9.69	1.37	52.8	5.5	62.3	6.6	67.0	7.4	12.6	2.0	7.51	1.05
V4	7.99	1.99	3.18	0.29	17.0	1.1	18.4	0.9	179	11	2.91	0.61	25.0	2.0	7.33	0.70	23.3	2.8	53.3	5.9	56.3	5.5	11.0	0.6	6.89	0.43
V5	3.95	0.53	2.77	0.13	11.9	0.6	13.5	0.5	134	5	1.85	0.36	17.7	1.1	3.14	0.46	19.4	1.9	45.2	7.7	48.3	8.0	4.30	0.73	2.86	0.36
V6	18.2	1.5	9.72	0.53	39.7	2.0	42.3	2.6	383	22	6.51	0.88	60.0	2.6	16.9	1.3	113	7	190	14	202	16	21.5	4.3	13.6	2.0
V7	41.2	5.4	6.35	0.49	30.8	2.2	38.7	2.3	297	17	7.32	0.69	43.8	3.4	7.50	0.36	65.4	7.4	46.7	5.0	51.2	5.4	10.6	1.5	5.51	0.57
V8	34.8	5.9	11.3	0.6	43.1	0.7	51.6	2.4	448	26	10.6	0.8	64.4	2.3	18.9	0.9	137	13	149	13	160	16	20.7	2.0	11.8	1.4
V9	32.4	4.6	10.5	0.7	38.6	1.7	47.4	1.9	384	17	11.1	0.5	63.6	3.6	15.6	0.6	128	11	119	10	125	12	18.2	2.5	10.4	1.4
R1	25.4	7.3	8.30	0.80	40.5	2.6	42.8	3.3	397	19	7.10	0.22	65.2	5.0	13.4	0.5	130	10	317	21	331	22	20.0	4.5	11.9	2.3
R2	19.3	1.8	9.16	0.53	37.3	3.1	39.0	2.3	342	27	7.75	0.33	61.2	5.4	14.1	1.0	121	11	283	25	296	25	18.4	1.4	11.7	0.5

Table 3: Averaged ISO Mainstream Smoke Constituent Yields

Sample Code	3-aminobiphenyl (ng/cig)		4-aminobiphenyl (ng/cig)		benzo[a]pyrene (ng/cig)		catechol (ug/cig)		m & p-cresols (ug/cig)		o-cresol (ug/cig)		hydroquinone (ug/cig)		phenol (ug/cig)		resorcinol (ug/cig)		pyridine (ug/cig)		quinoline (ug/cig)	
	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
E1	2.69	0.28	2.12	0.28	10.5	1.1	55.6	2.2	11.6	0.6	4.34	0.22	67.2	2.1	16.8	1.2	1.14	0.11	13.1	0.7	0.36	0.03
E2	1.97	0.24	1.63	0.24	6.00	0.71	30.2	1.9	4.96	0.21	1.56	0.20	28.8	2.3	5.96	0.82	0.564	0.100	5.47	0.43	0.18	0.01
E3	2.59	0.21	2.08	0.25	11.0	1.0	50.0	2.1	10.0	0.6	3.49	0.38	64.1	2.5	15.0	1.8	0.879	0.104	12.6	0.8	0.34	0.02
E4	1.18	0.11	0.969	0.052	3.32	0.33	16.9	1.1	1.97	0.15	0.751	0.115	18.3	1.2	2.01	0.58	NQ	NQ	2.61	0.56	0.09	0.01
E5	2.78	0.34	2.12	0.20	8.47	0.92	44.5	2.1	8.81	0.17	2.21	0.11	45.9	0.8	8.40	0.53	1.04	0.13	2.99	0.32	0.25	0.01
E6	0.874	0.068	0.745	0.063	1.56	0.22	8.59	0.59	0.625	0.144	NQ	NQ	6.94	0.78	NQ	NQ	BDL	BDL	1.19	0.19	0.04	0.00
E7	2.38	0.18	1.85	0.16	9.74	1.04	48.2	3.6	10.7	0.4	3.85	0.19	49.5	2.5	15.0	1.4	1.04	0.22	17.3	0.9	0.42	0.03
E8	2.18	0.15	1.70	0.15	5.34	0.55	27.0	1.1	4.54	0.30	1.51	0.11	25.5	1.2	5.78	0.58	NQ	NQ	2.36	0.43	0.17	0.01
E9	2.10	0.29	1.69	0.13	7.41	0.79	36.4	2.4	6.02	0.55	2.09	0.21	43.0	2.7	8.12	0.99	0.737	0.052	6.93	0.96	0.22	0.02
E10	2.72	0.16	2.09	0.05	8.91	0.95	50.8	3.8	12.1	0.4	4.29	0.29	57.2	2.4	17.7	2.0	1.12	0.12	13.1	0.9	0.46	0.04
E11	3.26	0.40	2.51	0.33	10.7	1.0	56.3	1.7	12.8	0.3	4.59	0.14	50.0	1.3	19.6	1.4	1.10	0.09	5.33	0.69	0.38	0.03
E12	1.71	0.20	1.26	0.13	8.92	1.36	60.1	4.5	7.44	0.43	2.92	0.24	58.6	3.8	11.6	0.9	0.821	0.148	5.11	0.50	0.22	0.02
E13	0.619	0.070	0.561	0.077	2.54	0.26	5.12	0.24	NQ	NQ	NQ	NQ	4.77	0.28	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL
E14	1.78	0.18	1.42	0.11	5.89	0.79	32.2	1.3	4.75	0.48	1.31	0.18	34.3	2.0	5.86	0.98	0.586	0.111	3.94	0.36	0.16	0.02
E15	1.34	0.06	1.01	0.13	3.55	0.38	11.7	0.9	1.17	0.08	0.363	0.023	10.8	0.7	NQ	NQ	NQ	NQ	1.11	0.24	0.03	0.00
E16	3.27	0.25	2.62	0.26	11.2	2.1	53.5	3.8	8.99	0.66	3.17	0.28	48.2	2.5	12.9	1.1	0.786	0.084	3.92	0.64	0.30	0.02
E17	3.20	0.37	2.40	0.31	11.9	1.0	64.7	1.6	11.2	0.5	4.07	0.26	50.4	1.9	16.9	0.8	0.990	0.084	13.1	1.1	0.39	0.03
E18	3.20	0.13	2.47	0.12	11.6	2.2	57.8	2.9	10.2	0.6	3.98	0.30	59.4	3.4	15.1	1.7	1.15	0.11	9.35	0.56	0.34	0.03
E19	2.08	0.28	1.61	0.23	7.12	0.69	40.1	1.5	5.78	0.24	2.22	0.12	41.1	1.6	8.43	0.45	0.936	0.064	4.42	0.55	0.18	0.01
E20	2.17	0.15	1.73	0.12	8.00	0.38	42.6	3.9	8.82	0.62	3.47	0.38	56.6	5.0	13.5	1.5	0.743	0.108	13.2	1.0	0.33	0.04
E21	0.829	0.065	0.715	0.092	2.00	0.05	5.23	0.39	NQ	NQ	NQ	NQ	5.85	0.48	BDL	BDL	BDL	BDL	0.943	0.544	NQ	NQ
E22	2.62	0.22	2.07	0.13	8.27	0.85	47.7	4.3	9.38	0.63	3.86	0.34	49.8	6.2	15.0	1.9	0.681	0.168	10.4	0.9	0.39	0.03
E23	2.23	0.21	1.67	0.10	7.02	0.80	46.4	1.4	10.2	0.9	3.76	0.31	52.0	1.2	14.2	1.0	0.901	0.059	3.16	1.09	0.31	0.04
E24	2.23	0.20	1.79	0.14	4.30	0.48	21.3	2.4	3.72	0.40	1.47	0.21	20.7	1.8	4.65	0.49	NQ	NQ	4.82	0.55	0.16	0.02
E25	2.73	0.29	2.04	0.25	12.4	1.3	54.7	3.4	12.6	0.5	4.98	0.45	64.2	5.6	19.7	3.0	1.12	0.16	15.3	0.8	0.43	0.03
E26	2.24	0.32	1.81	0.18	5.10	0.68	24.0	1.8	4.14	0.20	1.49	0.22	23.9	2.1	4.42	0.59	0.775	0.080	3.60	1.06	0.14	0.02
E27	1.40	0.13	1.13	0.14	3.12	0.40	16.8	2.2	1.94	0.17	0.668	0.119	17.6	2.3	NQ	NQ	NQ	NQ	1.98	0.30	0.10	0.01
E28	4.18	0.32	3.31	0.29	13.9	1.9	59.7	5.0	13.1	0.5	4.81	0.40	72.2	5.7	21.9	2.6	1.24	0.10	16.9	1.7	0.55	0.06
E29	3.29	0.52	2.59	0.36	9.50	1.10	47.4	4.4	10.5	1.0	3.70	0.53	47.3	4.3	13.9	1.5	0.959	0.179	13.0	1.4	0.37	0.03
E30	3.61	0.35	2.68	0.21	9.45	0.84	53.1	2.6	11.4	0.3	4.17	0.20	47.5	2.2	16.3	0.8	0.949	0.117	6.02	0.75	0.39	0.06
E31	0.635	0.117	0.507	0.086	1.50	0.12	10.3	0.9	1.04	0.10	0.418	0.068	10.4	0.7	NQ	NQ	NQ	NQ	1.22	0.45	0.03	0.01
E32	2.41	0.14	1.84	0.11	6.21	0.58	32.9	3.0	5.81	0.40	2.17	0.21	38.6	2.4	7.73	0.62	0.591	0.125	5.08	0.73	0.20	0.03
E33	1.76	0.16	1.45	0.12	3.11	0.33	18.4	0.8	2.47	0.21	0.890	0.048	17.8	0.7	2.83	0.26	NQ	NQ	2.18	0.43	0.09	0.01
E34	2.63	0.15	2.06	0.10	8.44	0.76	47.2	2.1	8.91	0.43	3.37	0.23	52.3	2.6	13.4	0.7	0.838	0.062	12.4	0.9	0.34	0.02
E35	2.64	0.21	2.14	0.18	7.46	0.66	41.1	1.9	8.32	0.59	3.18	0.32	42.1	2.1	11.3	0.8	0.895	0.086	7.55	0.62	0.28	0.02
E36	2.16	0.20	1.65	0.20	4.28	0.42	20.2	0.3	3.40	0.16	1.28	0.12	18.5	0.4	3.89	0.38	NQ	NQ	2.83	0.51	0.10	0.01
E37	1.40	0.16	1.20	0.06	2.35	0.27	10.2	0.6	1.66	0.09	0.628	0.040	16.1	0.6	2.17	0.09	NQ	NQ	2.18	0.52	0.07	0.01
E38	3.78	0.38	2.86	0.24	13.4	1.1	62.2	4.8	13.4	0.9	4.89	0.41	68.0	3.1	22.4	0.9	1.14	0.06	13.2	2.2	0.46	0.09
E39	1.65	0.16	1.44	0.18	5.20	0.47	30.1	0.8	4.87	0.37	1.80	0.19	27.5	0.7	5.93	0.61	NQ	NQ	1.88	0.44	0.14	0.04
V1	2.52	0.20	1.96	0.15	7.22	0.47	33.2	2.5	5.92	0.40	2.30	0.22	34.9	2.4	8.87	0.95	0.695	0.057	7.60	0.83	0.26	0.03
V2	2.40	0.14	1.82	0.11	12.8	1.3	73.4	5.0	13.3	0.8	5.75	0.47	75.1	3.2	23.7	2.5	0.685	0.067	12.7	2.0	0.56	0.03
V3	1.83	0.21	1.51	0.10	5.60	0.49	25.9	1.8	3.58	0.25	1.29	0.07	31.5	3.1	5.21	0.42	0.630	0.026	5.21	0.84	0.18	0.02
V4	1.67	0.04	1.35	0.07	4.31	0.42	19.4	1.5	2.68	0.20	0.987	0.060	19.6	1.2	3.65	0.29	0.547	0.095	3.33	0.82	0.14	0.01
V5	0.626	0.083	0.539	0.037	1.02	0.11	6.08	0.66	1.08	0.11	0.396	0.025	5.53	0.59	NQ	NQ	NQ	NQ	1.96	0.42	0.07	0.01
V6	2.97	0.23	2.20	0.08	9.26	0.50	34.1	1.5	4.72	0.24	1.64	0.15	34.2	2.2	8.51	0.51	0.816	0.029	7.40	0.98	0.24	0.03
V7	1.56	0.18	1.20	0.09	7.13	0.83	33.8	3.5	5.42	0.45	2.31	0.23	39.2	2.7	8.69	0.58	0.714	0.068	7.06	0.97	0.25	0.01
V8	3.16	0.20	2.43	0.15	9.67	0.56	43.1	2.2	9.09	0.53	3.54	0.34	43.9	3.0	14.6	1.5	1.11	0.04	16.2	1.9	0.50	0.03
V9	2.79	0.24	2.13	0.11	12.4	1.0	44.2	2.6	8.88	0.00	3.61	0.28	55.4	4.4	15.0	0.9	1.09	0.03	15.0	0.4	0.48	0.02
R1	2.97	0.45	2.30	0.36	7.33	1.38	40.9	2.0	8.43	0.42	3.50	0.29	39.2	1.9	11.3	0.5	0.957	0.076	8.02	0.36	0.28	0.02
R2	3.08	0.20	2.33	0.17	6.74	0.70	34.3	0.8	7.03	0.39	2.88	0.15	37.9	2.3	9.66	0.80	0.806	0.036	6.55	0.55	0.30	0.02

Table 3: Averaged ISO Mainstream Smoke Constituent Yields

Sample Code	NNN (2) (ng/cig)		NNK (2) (ng/cig)		NAT (2) (ng/cig)		NAB (2) (ng/cig)		mercury (ng/cig)		cadmium (ng/cig)		lead (ng/cig)		chromium (ng/cig)		nickel (ng/cig)		arsenic (ng/cig)		selenium (ng/cig)		pH	
	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
E1	78.2	7.4	52.0	5.3	71.0	5.7	10.8	1.8	3.24	0.78	46.9	3.6	23.4	1.2	NQ	NQ	BDL	BDL	NQ	NQ	BDL	BDL	6.16	0.04
E2	89.2	2.7	41.4	1.4	77.4	4.5	10.0	1.5	2.70	0.36	34.0	2.0	NQ	NQ	NQ	NQ	BDL	BDL	NQ	NQ	BDL	BDL	6.19	0.05
E3	189	10	104	4	160	9	18.6	3.4	3.08	0.13	50.9	3.4	20.1	1.4	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.17	0.06
E4	30.7	2.7	20.4	3.8	30.1	1.5	5.22	0.99	1.60	0.28	11.4	0.8	NQ	NQ	NQ	NQ	BDL	BDL	BDL	BDL	BDL	BDL	6.24	0.05
E5	148	10	75.0	3.5	129	9	18.5	2.1	2.27	0.35	17.2	1.2	21.1	1.2	NQ	NQ	BDL	BDL	NQ	NQ	BDL	BDL	6.17	0.06
E6	46.8	8.2	21.5	2.1	44.2	6.8	7.83	1.43	NQ	NQ	3.99	0.42	BDL	BDL	NQ	NQ	BDL	BDL	BDL	BDL	BDL	BDL	6.24	0.02
E7	100	7	79.5	6.5	107	2	14.6	2.5	2.87	0.37	31.3	2.4	23.3	2.2	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.13	0.04
E8	85.8	8.1	59.2	6.3	83.8	4.0	16.7	2.3	1.73	0.33	12.0	0.9	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.17	0.04
E9	58.5	5.0	37.9	6.1	54.4	6.2	9.39	1.75	2.63	0.31	30.8	2.6	15.8	1.7	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.15	0.04
E10	100	8	64.2	4.6	78.6	7.8	13.3	1.8	2.65	0.34	40.6	3.4	26.2	1.6	NQ	NQ	BDL	BDL	NQ	NQ	BDL	BDL	6.17	0.03
E11	161	4	96.2	5.9	143	7	24.7	2.4	2.41	0.38	27.6	1.0	22.8	1.3	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.14	0.04
E12	14.8	1.4	12.7	4.6	18.0	2.8	NQ	NQ	2.84	0.36	25.0	1.4	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.09	0.03
E13	45.0	3.3	18.6	3.1	40.8	3.4	7.16	1.02	BDL	BDL	2.83	0.12	BDL	BDL	NQ	NQ	BDL	BDL	BDL	BDL	BDL	BDL	6.26	0.03
E14	45.0	4.1	27.0	5.6	39.9	4.0	6.61	0.85	2.20	0.31	22.1	0.9	NQ	NQ	BDL	BDL	NQ	NQ	BDL	BDL	BDL	BDL	6.22	0.02
E15	46.6	5.8	28.5	3.5	40.3	6.7	6.84	1.37	NQ	NQ	10.2	0.7	NQ	NQ	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	6.17	0.04
E16	171	11	101	9	148	14	26.2	3.4	2.62	0.26	25.6	1.0	22.2	2.1	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.13	0.04
E17	157	24	108	17	140	20	26.6	3.0	3.46	0.25	65.8	4.0	25.8	1.7	BDL	BDL	BDL	BDL	3.92	1.41	BDL	BDL	6.04	0.05
E18	126	7	78.4	8.7	107	8	17.9	3.1	3.44	0.88	50.5	2.7	22.7	1.5	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.19	0.03
E19	57.1	3.6	36.1	5.3	52.6	6.3	8.98	0.53	2.33	0.25	23.6	1.4	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.19	0.03
E20	48.1	3.9	27.7	4.9	44.1	3.0	7.23	1.22	2.72	0.42	27.4	2.9	16.8	4.0	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.09	0.04
E21	42.5	4.7	16.0	2.7	38.6	3.3	7.17	1.35	BDL	BDL	1.81	0.57	BDL	BDL	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.16	0.04
E22	52.4	5.4	37.7	2.4	50.3	4.1	9.81	1.65	2.83	0.19	31.0	2.6	18.2	0.7	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.12	0.03
E23	47.2	3.6	42.4	7.7	46.9	3.6	7.15	1.40	1.66	0.22	8.47	0.77	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.13	0.05
E24	104	4	53.9	8.8	91.2	5.0	16.3	1.6	1.96	0.24	24.6	1.2	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.23	0.06
E25	54.9	4.5	36.7	7.4	52.4	4.1	5.98	1.29	3.28	0.33	42.1	3.0	21.1	2.8	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.08	0.06
E26	95.1	4.6	55.1	4.7	88.1	5.1	16.0	1.8	2.09	0.45	35.0	4.6	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.17	0.05
E27	30.0	2.1	19.4	2.8	30.7	3.8	6.28	1.10	NQ	NQ	8.87	1.23	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.22	0.02
E28	195	12	87.3	8.2	153	10	28.5	3.7	3.83	0.16	66.3	3.2	31.4	1.6	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.13	0.08
E29	152	9	106	7	135	4	22.3	3.0	3.59	0.62	59.4	2.9	23.7	3.7	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.12	0.04
E30	146	7	87.1	4.4	136	9	15.6	1.7	2.93	0.33	31.2	1.4	23.1	2.2	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.02	0.03
E31	5.04	1.35	NQ	NQ	7.96	2.46	NQ	NQ	BDL	BDL	4.28	0.35	NQ	NQ	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	6.10	0.01
E32	66.5	5.4	44.6	5.3	59.5	4.9	8.01	1.14	2.45	0.24	27.6	2.3	13.3	3.4	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.10	0.03
E33	72.1	6.7	46.1	4.6	67.2	7.4	10.1	0.7	NQ	NQ	11.2	0.7	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.13	0.02
E34	66.8	3.1	49.7	1.6	61.2	2.1	6.90	1.05	2.91	0.38	37.3	2.3	19.9	1.9	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.01	0.02
E35	70.9	6.7	57.7	7.0	63.4	6.5	7.56	1.52	2.83	0.27	39.6	3.0	17.3	1.6	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.04	0.03
E36	78.6	10.6	53.4	8.5	71.5	7.3	10.8	1.5	1.75	0.28	23.3	2.1	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.11	0.01
E37	33.5	3.1	26.9	4.3	33.9	2.7	5.29	0.83	NQ	NQ	8.67	0.70	NQ	NQ	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	6.13	0.03
E38	125	8	74.2	4.3	84.6	8.9	14.1	2.3	3.31	0.54	43.3	1.5	27.6	2.5	BDL	BDL	BDL	BDL	5.48	1.17	BDL	BDL	5.99	0.02
E39	63.4	6.2	45.0	4.9	55.7	5.1	7.77	0.94	1.54	0.56	9.26	0.82	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.08	0.04
V1	142	5	90.1	8.7	120	4	15.4	2.4	2.77	0.24	32.2	3.0	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.27	0.07
V2	26.6	2.5	34.3	3.1	42.7	1.8	6.56	0.75	3.69	0.20	34.2	3.2	16.7	5.3	NQ	NQ	BDL	BDL	NQ	NQ	BDL	BDL	6.17	0.06
V3	41.1	6.7	23.7	4.1	36.3	4.0	4.28	0.77	2.67	0.36	26.8	2.9	13.0	3.3	NQ	NQ	BDL	BDL	NQ	NQ	BDL	BDL	6.21	0.05
V4	62.7	5.9	42.2	6.2	58.9	4.9	7.60	1.19	1.99	0.15	13.0	1.8	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.28	0.03
V5	38.0	6.6	19.2	3.8	37.6	5.1	6.42	1.19	1.68	0.18	5.14	0.65	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	6.27	0.03
V6	127	13	87.4	10.3	119	10	18.9	2.8	3.71	0.22	45.6	3.8	13.9	4.0	NQ	NQ	NQ	NQ	NQ	NQ	BDL	BDL	6.15	0.04
V7	17.0	2.5	30.1	8.4	28.6	3.3	2.87	0.93	2.75	0.32	28.0	2.3	NQ	NQ	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.14	0.04
V8	117	5	47.3	1.2	97.2	3.0	13.2	1.3	4.66	0.36	101	12	21.7	1.6	BDL	BDL	BDL	BDL	4.29	1.04	BDL	BDL	6.20	0.04
V9	63.5	8.0	51.8	6.3	56.3	3.6	9.27	1.23	3.58	0.34	46.4	5.9	16.9	2.2	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	6.22	0.04
R1	107	4	75.6	8.5	118	8	25.3	3.1	5.17	0.40	68.7	1.7	39.2	1.9	BDL	BDL	BDL	BDL	4.66	1.26	BDL	BDL	5.92	0.04
R2	109	13	87.7	12.4	127	11	21.8	2.1	6.27	0.33	62.2	4.6	35.6	2.9	BDL	BDL	BDL	BDL	NQ	NQ	BDL	BDL	5.97	0.10

Table 4: Mainstream Smoke Constituents at the Limits of Detection (LOD) and Limits of Quantitation (LOQ)

Smoke Constituent	unit	LOD	LOQ	# of Brands at Limits
nickel	ng/cig	6.47	21.6	48
chromium	ng/cig	5.94	19.8	48
selenium	ng/cig	2.21	7.37	48
arsenic	ng/cig	1.13	3.75	45
resorcinol	µg/cig	0.158	0.526	14
crotonaldehyde	µg/cig	0.980	3.29	11
mercury	ng/cig	1.10	1.50	8
phenol	µg/cig	0.573	1.91	5
o-cresol	µg/cig	0.074	0.245	3
NAB	ng/cig	0.634	2.00	2
quinoline	µg/cig	0.007	0.024	2
m & p-cresols	µg/cig	0.153	0.509	2
acrylonitrile	µg/cig	0.282	0.939	2
toluene	µg/cig	2.50	8.32	2
NNK	ng/cig	3.72	12.4	1
ammonia	µg/cig	0.725	2.45	1
acrolein	µg/cig	0.710	2.37	1
propionaldehyde	µg/cig	1.00	3.33	1
methyl ethyl ketone	µg/cig	1.09	3.66	1
NNK	ng/cig	3.72	12.4	1
pyridine	µg/cig	0.237	0.791	1
styrene	µg/cig	0.170	0.560	1

Table 5: Weighted Regression of ISO Smoke Constituent Yields with ISO "Tar," Nicotine or Carbon Monoxide

Constituents	With ISO Tar (weighted by 1/tar)			With ISO Nicotine (weighted by 1/nicotine)			With ISO Carbon Monoxide (weighted by 1/CO)		
	RSQ	RMSE	PRESS	RSQ	RMSE	PRESS	RSQ	RMSE	PRESS
Vapor Phase									
acetaldehyde	0.96	16.6	11852	0.93	74.6	224892	0.96	16.2	10821
acetone	0.93	10.6	4799	0.90	43.9	78289	0.93	9.93	4104
acrolein	0.93	2.11	181	0.89	9.11	3326	0.92	2.18	191
butyraldehyde	0.91	1.53	96	0.87	6.52	1711	0.90	1.62	105
crotonaldehyde	0.80	1.26	66	0.71	5.45	1208	0.75	1.43	84
methyl ethyl ketone	0.89	3.17	417	0.84	13.5	7286	0.89	3.22	421
propionaldeyde	0.94	1.93	155	0.90	8.43	2861	0.93	1.99	161
acrylonitrile	0.92	0.41	7	0.86	1.85	137	0.89	0.47	9
benzene	0.86	2.04	173	0.84	7.67	2398	0.87	1.95	155
1,3-butadiene	0.95	1.42	88	0.94	5.13	1103	0.96	1.13	54
isoprene	0.91	15.8	10270	0.90	54.5	121776	0.91	14.8	8892
styrene	0.80	0.59	14	0.72	2.52	255	0.75	0.67	18
toluene	0.87	3.12	393	0.82	12.5	6248	0.86	3.17	402
hydrogen cyanide	0.91	6.50	1730	0.87	27.1	30182	0.87	7.87	2549
mercury	0.91	0.10	0.4	0.88	0.39	6	0.90	0.10	0.43
Particulate Phase									
formaldehyde	0.91	1.76	126	0.84	8.09	2633	0.88	1.99	161
ammonia	0.93	0.75	23	0.93	2.67	296	0.90	0.91	34
1-aminonaphthalene	0.88	0.99	42	0.91	2.86	343	0.87	1.02	43
2-aminonaphthalene	0.86	0.68	20	0.89	2.00	165	0.85	0.69	19
3-aminobiphenyl	0.89	0.14	1	0.92	0.40	7	0.88	0.14	1
4-aminobiphenyl	0.87	0.11	1	0.90	0.33	4	0.87	0.11	1
benzo[a]pyrene	0.94	0.36	6	0.93	1.38	85	0.90	0.48	10
catechol	0.94	2.05	171	0.95	6.42	1655	0.92	2.32	215
m & p-cresols	0.96	0.37	5	0.94	1.53	95	0.90	0.56	13
o-cresol	0.94	0.16	1	0.92	0.66	18	0.88	0.23	2
hydroquinone	0.93	2.31	217	0.91	9.42	3560	0.90	2.87	330
phenol	0.92	0.75	23	0.90	3.03	377	0.85	1.08	47
resorcinol	0.80	0.07	0.2	0.83	0.20	1.9	0.80	0.06	0.2
pyridine	0.81	0.83	28	0.72	3.61	527	0.74	0.98	39
quinoline	0.96	0.01	0.01	0.93	0.06	0.14	0.90	0.02	0.02
cadmium	0.83	3.05	369	0.80	11.5	5269	0.82	3.13	393
lead	0.80	1.40	96	0.84	4.23	831	0.81	1.36	86

Prediction Error (PE) = Predicted - Measured
-PE = under predicted (measured yield above line)
+PE = over predicted (measured yield below line)

Table 6: Prediction Errors using ISO "Tar" with a Weighted Linear Regression

		V1				V2				V3				V4				V5			
MS Constituents (ISO) WLS (1/Tar)	**Units**	**Measured Yields**		**Predicted Yields**	**PE**	**Measured Yields**		**Predicted Yields**	**PE**	**Measured Yields**		**Predicted Yields**	**PE**	**Measured Yields**		**Predicted Yields**	**PE**	**Measured Yields**		**Predicted Yields**	**PE**
Vapor - ISO Tar		Average	St Dev			Average	St Dev			Average	St Dev			Average	St Dev			Average	St Dev		
acetaldehyde	ug/cig	383	41	361	-2	643	40	521	-121	319	17	276	-43	147	16	189	43	***129***	***13***	***74.6***	***-54***
acetone	ug/cig	201	17	204	3	335	18	279	-56	176	10	164	-12	96.5	8.8	124	27.0	86.8	5.4	70.0	-16.8
acrolein	ug/cig	30.8	4.6	32.2	1.4	60.3	4.5	47.2	-13.1	27.8	1.5	24.3	-3.3	12.1	1.6	16.2	4.1	9.75	0.81	5.44	-4.31
butyraldehyde	ug/cig	24.7	3.7	23.5	-1.2	***47.5***	***3.3***	***33.3***	***-14.2***	20.9	1.5	18.4	-2.6	11.4	1.2	13.1	1.7	10.2	1.5	6.12	-4.1
crotonaldehyde	ug/cig	10.9	1.7	10.9	0.0	***28.3***	***2.9***	***15.9***	***-12.4***	8.86	1.10	8.22	-0.64	3.29	NQ	5.52	2.23	3.29	NQ	3.29	0.00
methyl ethyl ketone	ug/cig	41.8	4.2	41.4	-0.3	78.0	6.1	59.8	-18.2	34.5	2.8	31.7	-2.8	15.9	1.7	21.8	5.9	13.4	1.1	8.67	-4.7
propionaldeyde	ug/cig	32.8	3.9	33.5	0.7	56.4	3.3	48.2	-8.2	28.1	1.7	25.7	-2.4	13.8	1.6	17.8	4.0	11.8	1.1	7.29	-4.6
acrylonitrile	ug/cig	7.43	0.61	6.00	-1.43	11.1	0.8	8.67	-2.5	5.50	0.24	4.57	-0.92	3.18	0.29	3.13	-0.05	2.77	0.13	1.21	-1.56
benzene	ug/cig	30.7	1.9	27.9	-2.8	44.4	2.8	38.1	-6.3	25.4	1.5	22.5	-2.9	17.0	1.1	17.0	0.0	11.9	0.8	9.69	-2.3
1,3-butadiene	ug/cig	35.0	2.1	31.2	-3.8	***54.1***	***5.6***	***42.9***	***-11.2***	29.3	2.6	24.9	-4.4	19.4	0.9	18.6	-0.8	13.5	0.5	10.2	-3.3
isoprene	ug/cig	291	19	272	-19	466	43	368	-98	244	21	220	-24	179	11	168	-11	134	5	98.6	-36
styrene	ug/cig	5.91	0.62	5.24	-0.68	10.4	1.4	7.60	-2.8	4.66	0.68	3.98	-0.58	2.91	0.61	2.71	-0.20	1.85	0.38	1.02	-0.83
toluene	ug/cig	47.6	3.6	40.7	-7.0	67.5	3.3	56.6	-10.9	38.2	2.5	32.3	-5.9	25.0	2.0	23.8	-1.2	17.7	1.1	12.5	-5.3
hydrogen cyanide	ug/cig	68.3	3.7	74.3	6.0	135	12	114	-20	52.8	5.5	53.0	0.2	23.8	2.0	31.4	8.0	19.4	1.9	2.72	-16.7
mercury	ng/cig	2.77	0.24	2.38	-0.40	3.69	0.20	3.00	-0.69	2.67	0.36	2.04	-0.62	1.99	0.15	1.71	-0.28	1.68	0.18	1.26	-0.42
Particulate - ISO Tar																					
formaldehyde	ug/cig	19.0	3.5	21.8	2.7	40.6	6.7	32.6	-8.0	17.3	1.9	16.0	-1.3	7.99	1.99	10.2	2.16	3.95	0.53	2.39	-1.56
ammonia	ug/cig	14.0	1.0	13.2	-0.8	***12.4***	***1.2***	***18.7***	***6.3***	9.69	1.37	10.3	0.62	7.33	0.70	7.36	0.03	3.14	0.46	3.44	0.30
1-aminonaphthalene	ng/cig	15.6	1.3	15.1	-0.5	18.1	3.2	20.4	2.3	12.6	2.0	12.3	-0.4	11.0	0.6	9.42	-1.6	4.30	0.73	5.61	1.32
2-aminonaphthalene	ng/cig	9.80	1.09	9.61	-0.18	9.61	1.32	12.9	3.19	7.51	1.05	7.65	0.34	6.89	0.43	6.07	-0.82	2.66	0.36	3.71	1.05
3-aminobiphenyl	ng/cig	2.52	0.20	2.28	-0.24	2.40	0.14	3.06	0.66	1.83	0.21	1.87	0.03	1.67	0.04	1.45	-0.23	0.626	0.083	0.890	0.264
4-aminobiphenyl	ng/cig	1.98	0.15	1.79	-0.19	1.82	0.11	2.37	0.55	1.51	0.10	1.48	-0.03	1.35	0.07	1.17	-0.19	0.539	0.037	0.749	0.210
benzo[a]pyrene	ng/cig	7.22	0.47	7.23	0.01	12.8	1.3	10.2	-2.6	5.60	0.49	5.68	0.08	4.31	0.42	4.11	-0.20	***1.02***	***0.11***	***2.02***	***1.00***
catechol	ug/cig	33.2	2.5	37.0	3.8	***73.4***	***5.0***	***53.1***	***-20.3***	25.9	1.6	28.4	2.5	19.4	1.5	19.7	0.3	6.06	0.66	8.10	2.02
m & p-cresol	ug/cig	5.92	0.48	6.93	1.01	***13.3***	***0.8***	***10.4***	***-2.8***	3.58	0.25	5.06	1.48	2.68	0.20	3.17	0.49	1.08	0.11	0.659	-0.42
o-cresol	ug/cig	2.30	0.22	2.55	0.25	***5.76***	***0.47***	***3.83***	***-1.91***	1.29	0.07	1.87	0.58	0.987	0.050	1.18	0.192	0.396	0.025	0.264	-0.132
hydroquinone	ug/cig	34.9	2.4	38.7	3.7	***75.1***	***3.2***	***55.9***	***-19.2***	31.5	3.1	29.6	-1.9	19.6	1.2	20.2	0.6	5.53	0.59	7.95	2.42
phenol	ug/cig	8.67	0.85	10.0	1.29	***23.7***	***2.5***	***15.2***	***-8.6***	5.21	0.42	7.19	1.97	3.65	0.29	4.37	0.72	1.91	NQ	1.91	0.00
resorcinol	ug/cig	0.695	0.057	0.759	0.064	0.685	0.067	1.02	0.331	0.630	0.026	0.622	-0.008	0.547	0.095	0.463	-0.084	0.526	NQ	0.526	0.000
pyridine	ug/cig	7.60	0.83	6.77	-0.83	12.7	2.0	10.2	-2.5	5.21	0.84	4.97	-0.24	3.33	0.82	3.14	-0.19	1.96	0.42	0.724	-1.24
quinoline	ug/cig	0.262	0.029	0.244	-0.018	***0.580***	***0.032***	***0.367***	***-0.192***	0.189	0.017	0.178	-0.011	0.139	0.011	0.112	-0.027	0.087	0.013	0.024	-0.043
cadmium	ng/cig	32.2	3.0	27.7	-4.5	34.2	3.2	40.9	6.7	26.8	2.9	20.7	-6.1	13.0	1.8	13.5	0.5	5.14	0.65	4.08	-1.06
lead	ng/cig	12.8	NQ	16.6	3.8	16.7	5.3	22.2	5.5	13.0	3.3	13.6	0.6	12.8	NQ	12.8	0.0	3.85	BDL	3.85	0.00

1. Prediction Error (PE) = Predicted yields - Measured yields
2. Yields in bold are outside of the 95% predicted interval.
3. When predicted yield < LOQ and > LOD, LOQ is reported.
When predicted yield < LOD, LOD is reported.

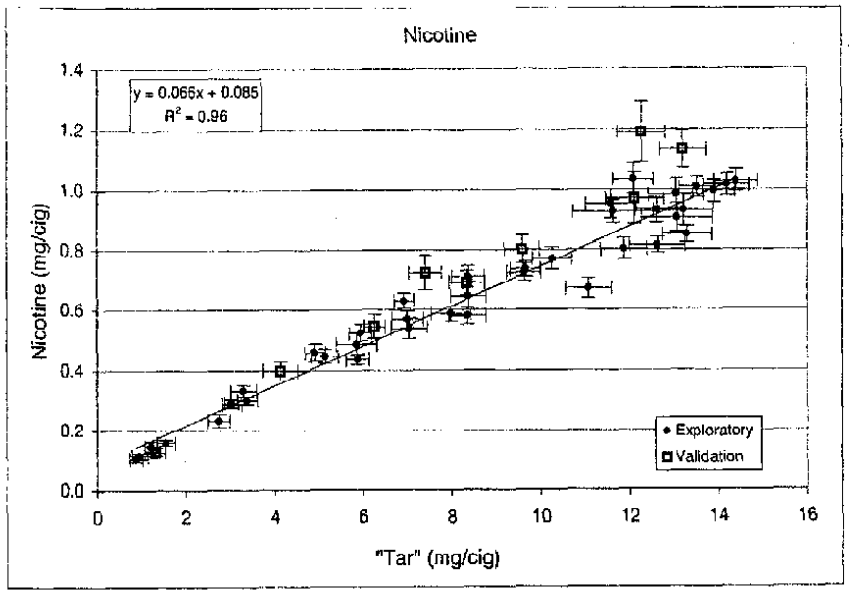
Prediction Error (PE) = Predicted - Measured
-PE = under predicted (measured yield above line)
+PE = over predicted (measured yield below line)

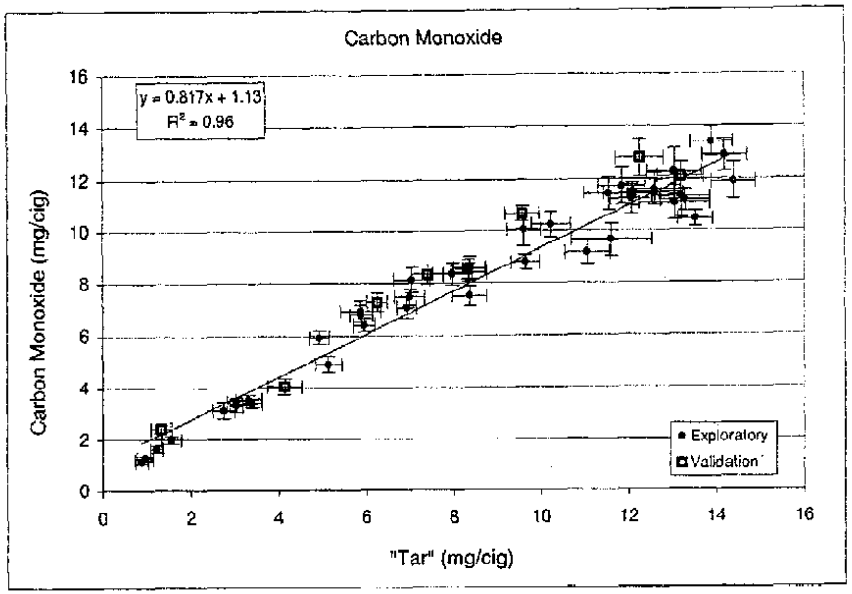
Table 6: Prediction Errors using ISO "Tar" with a Weighted Linear Regression

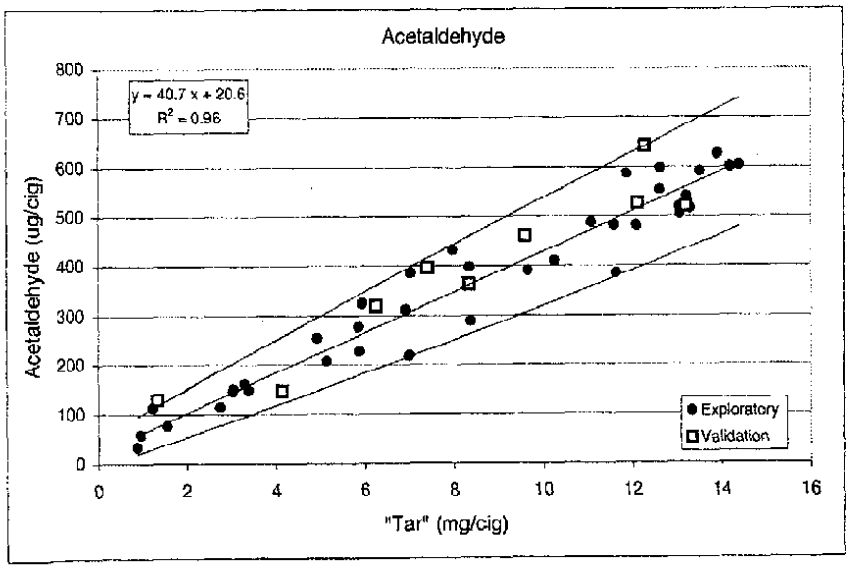
		V6				V7				V8				V9			
MS Constituents (ISO) WLS (1/Tar)	**Units**	**Measured Yields**		**Predicted Yields**	**PE**	**Measured Yields**		**Predicted Yields**	**PE**	**Measured Yields**		**Predicted Yields**	**PE**	**Measured Yields**		**Predicted Yields**	**PE**
Vapor - ISO Tar		Average	St Dev			Average	St Dev			Average	St Dev			Average	St Dev		
acetaldehyde	ug/cig	461	61	411	-50	396	31	323	-73	520	49	559	39	527	84	515	-12
acetone	ug/cig	282	30	227	-34	224	15	186	-38	298	26	297	-2	288	25	276	-12
acrolein	ug/cig	42.8	6.4	37.0	-5.6	39.9	3.2	28.7	-11.2	50.7	5.3	50.8	0.0	47.7	6.4	46.6	-1.1
butyraldehyde	ug/cig	33.1	4.2	26.6	-6.5	27.0	1.6	21.2	-5.8	35.7	3.2	35.6	-0.1	36.9	4.7	32.9	-4.1
crotonaldehyde	ug/cig	15.8	2.6	12.4	-3.4	16.5	1.9	9.88	-6.6	22.8	2.6	17.0	-5.8	22.8	3.0	15.7	-7.2
methyl ethyl ketone	ug/cig	53.9	5.1	47.2	-6.7	48.4	3.5	37.1	-11.3	62.8	6.4	64.1	1.3	64.2	5.4	59.0	-5.2
propionaldeyde	ug/cig	42.6	4.5	38.1	-4.4	35.4	2.8	30.0	-5.4	47.8	4.3	51.7	3.9	48.0	5.4	47.6	-0.4
acrylonitrile	ug/cig	***9.72***	***0.53***	***6.84***	***-2.88***	6.35	0.49	5.36	-0.99	11.3	0.6	9.31	-2.0	10.5	0.7	8.56	-2.0
benzene	ug/cig	39.7	2.0	31.1	-8.5	30.8	2.2	25.5	-5.3	43.1	0.7	40.5	-2.6	39.6	1.7	37.7	-1.9
1,3-butadiene	ug/cig	42.3	2.6	34.9	-7.5	***33.7***	***2.3***	***28.4***	***-10.4***	51.6	2.4	45.7	-5.9	47.4	1.9	42.4	-5.0
isoprene	ug/cig	383	22	302	-81	297	17	248	-48	448	26	391	-57	364	17	364	0
styrene	ug/cig	6.51	0.86	5.98	-0.53	7.32	0.69	4.67	-2.65	10.6	0.8	8.15	-2.4	11.1	0.5	7.50	-3.6
toluene	ug/cig	60.0	2.6	45.7	-14.3	43.8	3.4	37.0	-6.8	64.4	2.3	60.3	-4.1	63.6	3.6	55.9	-7.7
hydrogen cyanide	ug/cig	113	7	87.0	-25.9	65.4	7.4	64.7	-0.7	137	13	124	-13	128	11	113	-15
mercury	ng/cig	***3.71***	***0.22***	***2.57***	***-1.14***	2.75	0.32	2.23	-0.52	***4.86***	***0.36***	***3.15***	***-1.52***	3.56	0.34	2.97	-0.61
Particulate - ISO Tar																	
formaldehyde	ug/cig	18.2	1.5	25.2	7.0	***41.2***	***5.4***	***19.2***	***-22.0***	34.8	5.9	35.2	0.4	32.4	4.8	32.2	-0.2
ammonia	ug/cig	16.9	1.3	15.0	-2.0	7.50	0.36	11.9	4.42	18.9	0.9	20.0	1.1	15.6	0.6	18.5	2.8
1-aminonaphthalene	ng/cig	21.5	4.3	16.8	-4.7	10.6	1.5	13.8	3.3	20.7	2.0	21.7	1.0	18.2	2.5	20.2	2.0
2-aminonaphthalene	ng/cig	13.6	2.0	10.7	-2.9	5.61	0.57	8.82	3.21	11.8	1.4	13.7	1.9	10.4	1.4	12.8	2.4
3-aminobiphenyl	ng/cig	2.97	0.23	2.53	-0.44	1.66	0.16	2.09	0.54	3.16	0.20	3.24	0.08	2.79	0.24	3.03	0.24
4-aminobiphenyl	ng/cig	2.20	0.06	1.97	-0.23	1.20	0.09	1.65	0.45	2.43	0.15	2.51	0.08	2.13	0.11	2.35	0.22
benzo[a]pyrene	ng/cig	9.28	0.50	8.15	-1.13	7.13	0.93	6.54	-0.60	9.67	0.56	10.8	1.17	12.4	1.0	10.0	-2.3
catechol	ug/cig	34.1	1.5	42.1	7.9	33.8	3.5	33.1	-0.7	43.1	2.2	57.0	13.8	44.2	2.6	52.5	8.3
m & p-cresol	ug/cig	***4.72***	***0.24***	***8.03***	***3.31***	5.42	0.45	6.09	0.67	9.09	0.53	11.3	2.17	8.89	0.60	10.3	1.40
o-cresol	ug/cig	***1.64***	***0.15***	***2.96***	***1.32***	2.31	0.23	2.25	-0.06	3.54	0.34	4.13	0.59	3.61	0.26	3.78	0.17
hydroquinone	ug/cig	34.2	2.2	44.1	9.9	39.2	2.7	34.8	-4.8	43.9	3.0	60.0	16.0	55.4	4.4	55.2	-0.2
phenol	ug/cig	***6.51***	***0.51***	***11.6***	***5.10***	8.69	0.56	8.72	0.03	14.8	1.5	16.4	1.7	15.0	0.9	15.0	0.0
resorcinol	ug/cig	0.816	0.029	0.840	0.024	0.714	0.068	0.697	-0.016	1.11	0.04	1.08	-0.04	1.09	0.03	1.01	-0.09
pyridine	ug/cig	7.40	0.98	7.84	0.44	7.06	0.97	5.96	-1.10	16.2	1.9	11.0	-5.2	15.0	0.4	10.0	-4.9
quinoline	ug/cig	0.243	0.026	0.283	0.040	0.254	0.015	0.215	-0.040	0.499	0.028	0.397	-0.102	***0.485***	***0.018***	***0.362***	***-0.122***
cadmium	ng/cig	45.6	3.6	31.9	-13.7	28.0	2.3	24.0	-3.5	***101***	***12***	***44.1***	***-57***	46.4	5.0	40.4	-8.0
lead	ng/cig	13.9	4.0	18.3	4.5	12.8	NQ	15.2	2.4	21.7	1.6	23.5	1.8	18.9	2.2	22.0	5.1

1. Prediction Error (PE) = Predicted yields - Measured yields
2. Yields in bold are outside of the 95% predicted interval.
3. When predicted yield < LOQ and > LOD, LOQ is reported.
When predicted yield < LOD, LOD is reported.

Figure 1: Regression Plots from Weighted Linear Regression with 1/"tar" Weighting







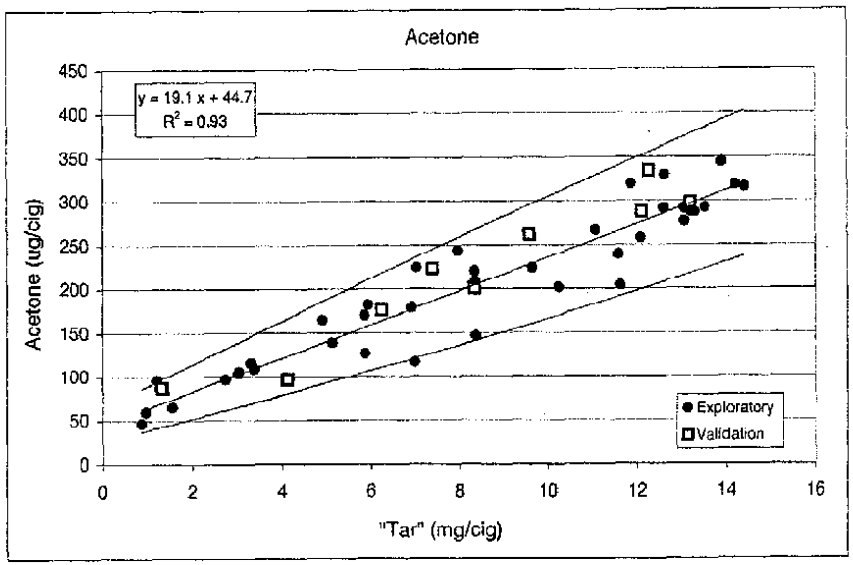
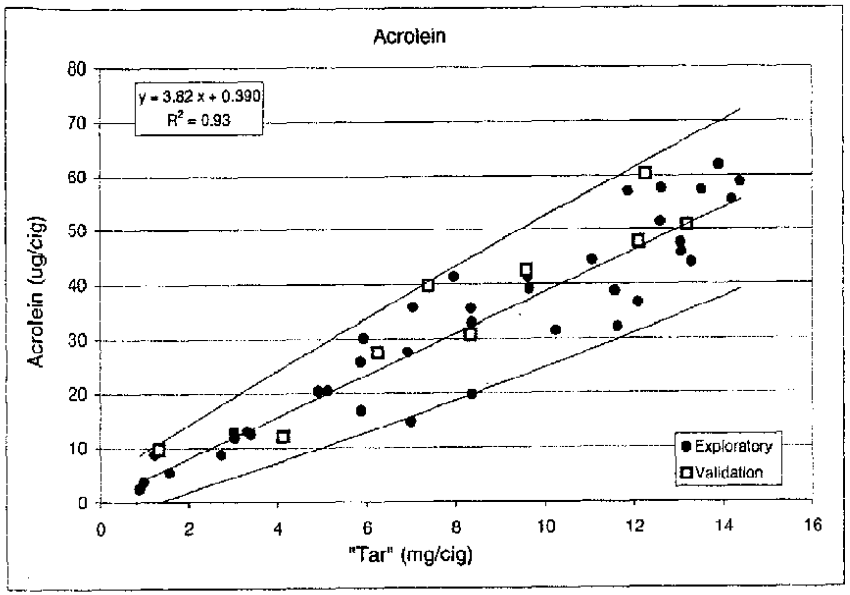
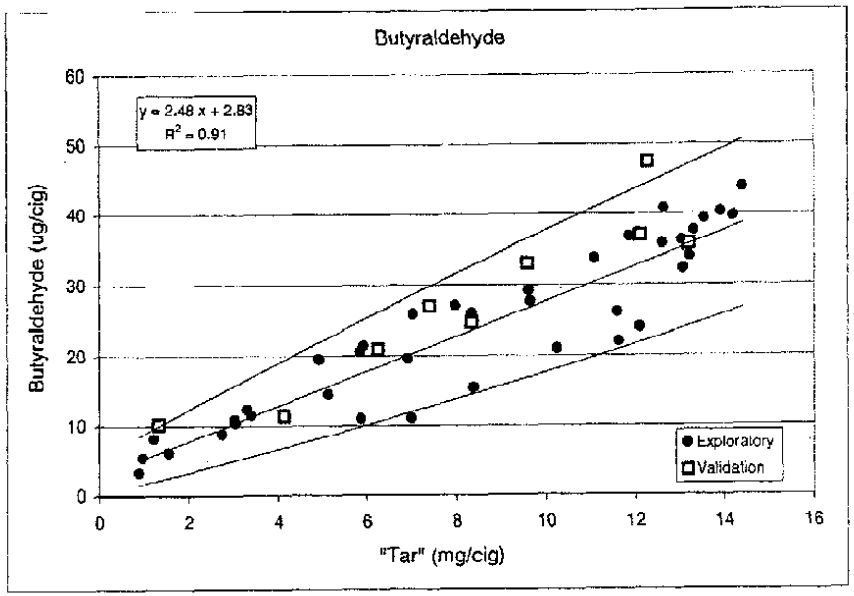
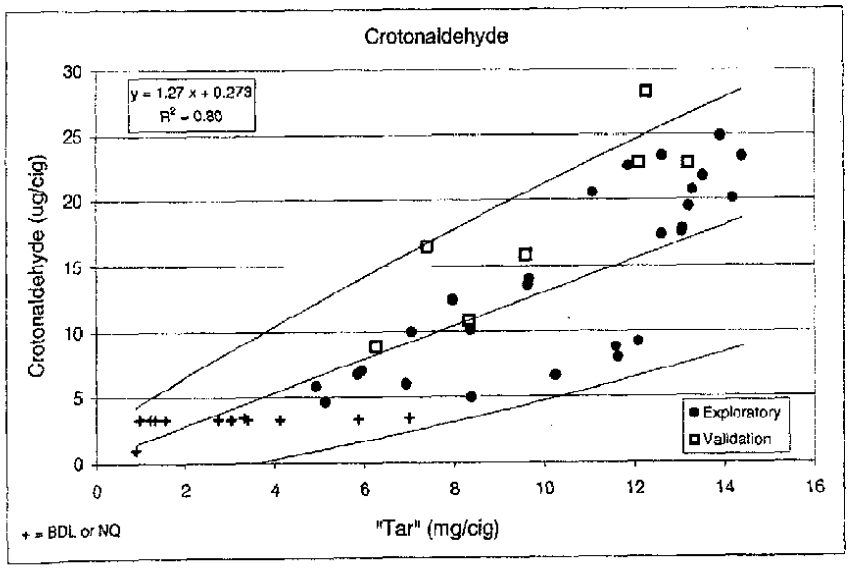


Figure 1: Regression Plots from Weighted Linear Regression from 1/"tar" Weighting







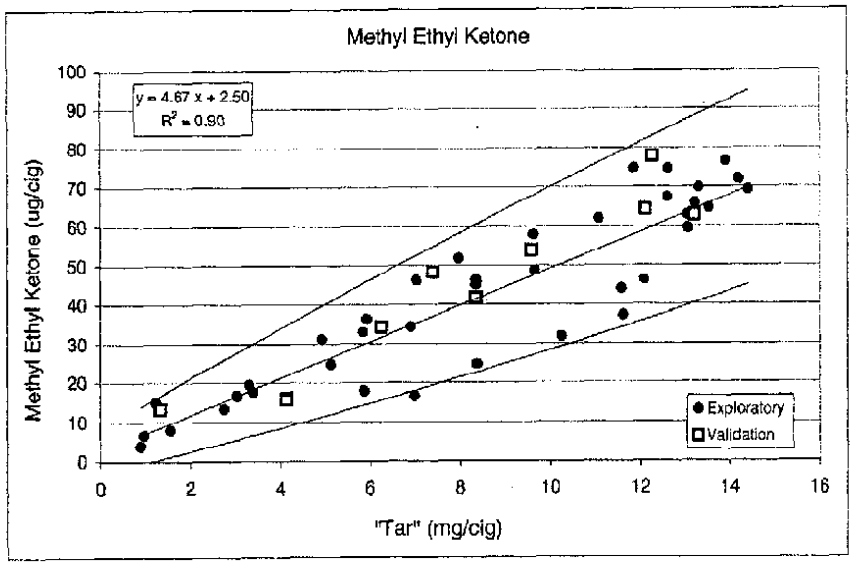
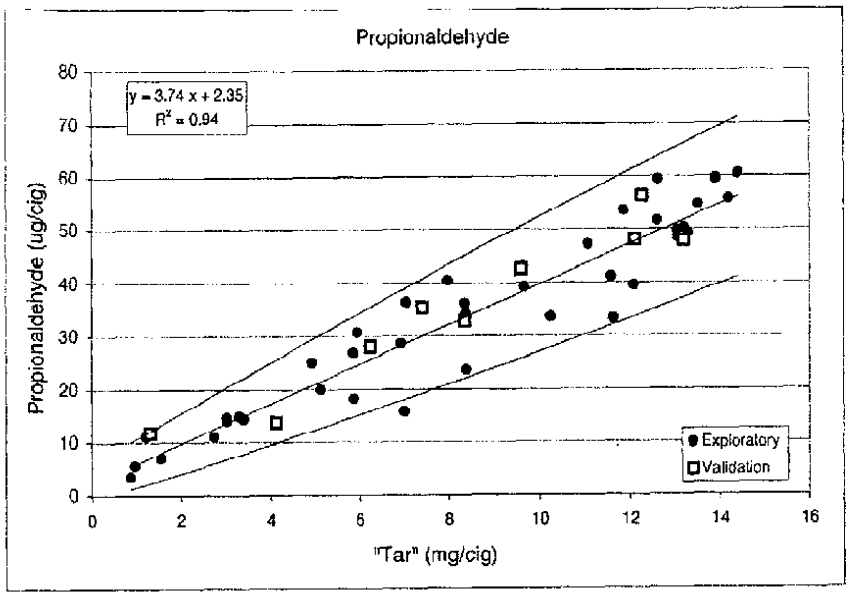
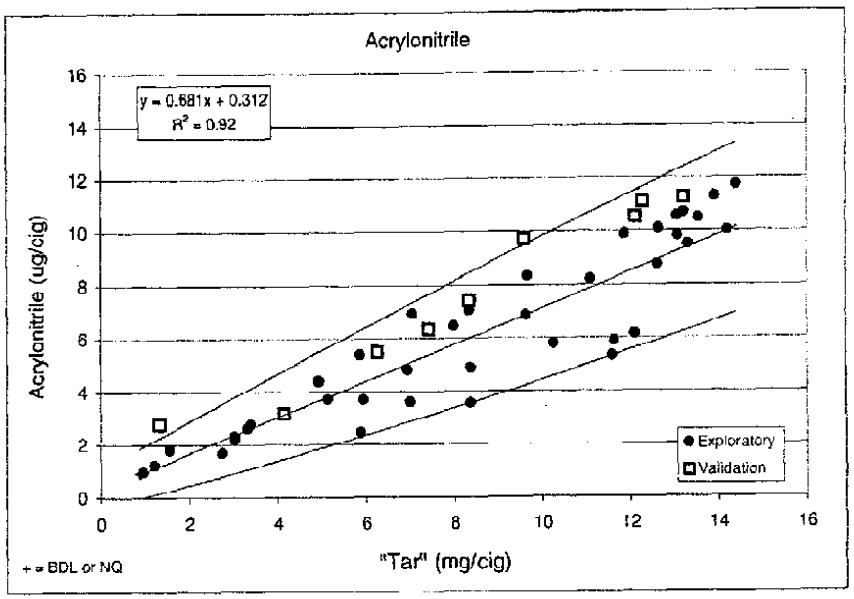
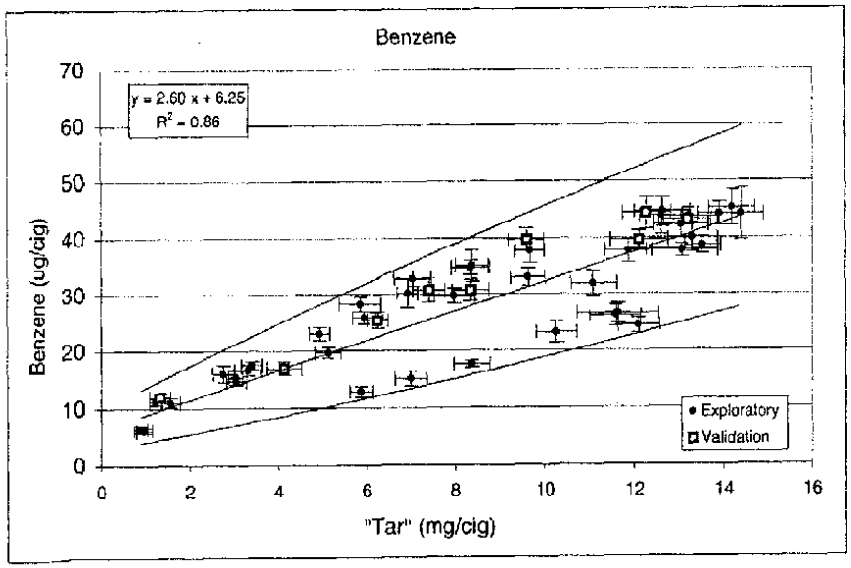
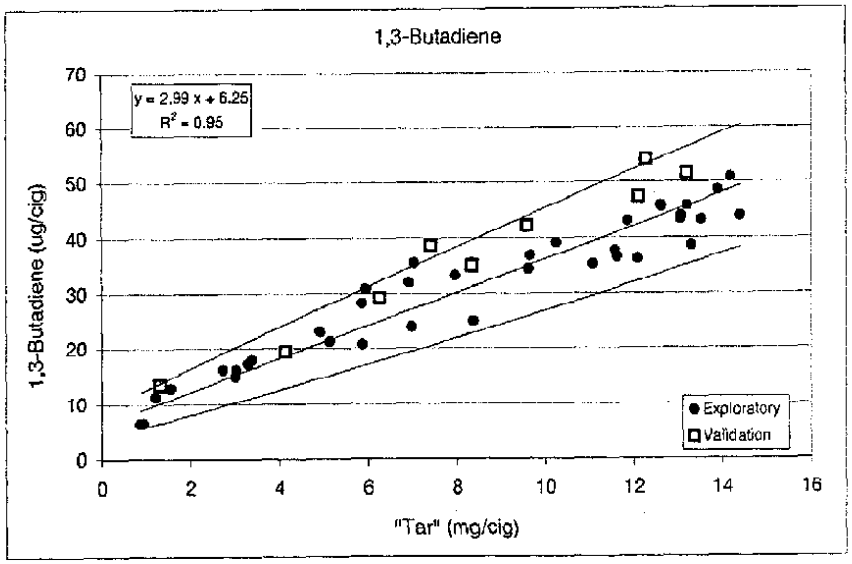


Figure 1: Regression PLots from Weighted Linear Regression with 1/"tar" Weighting









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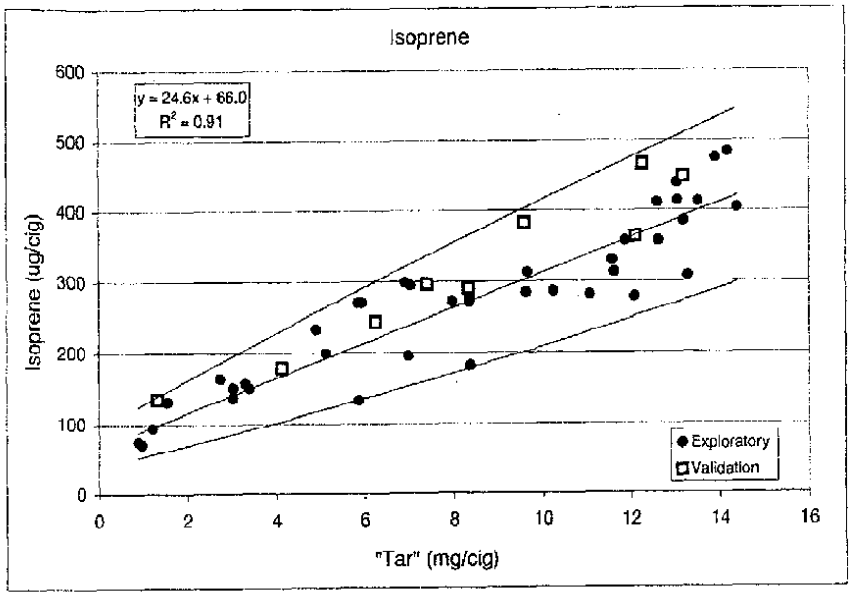
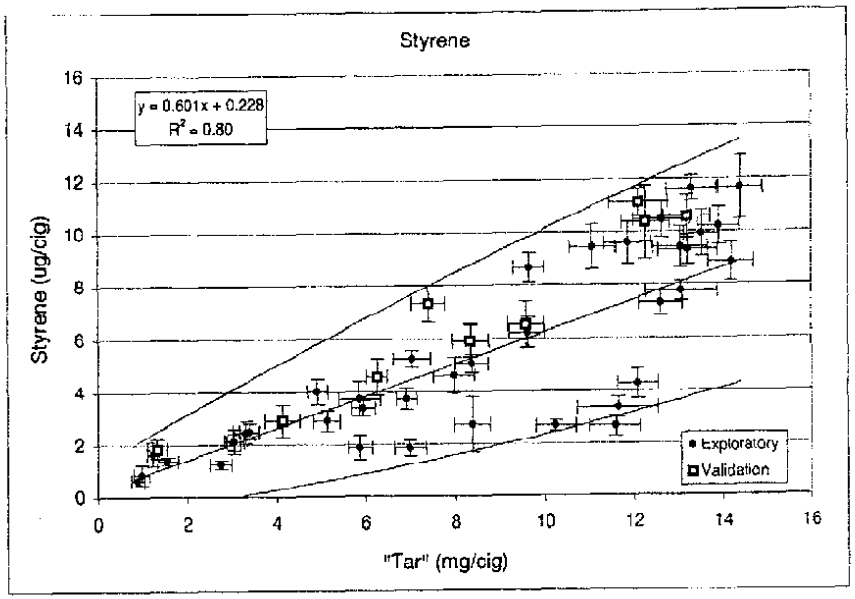
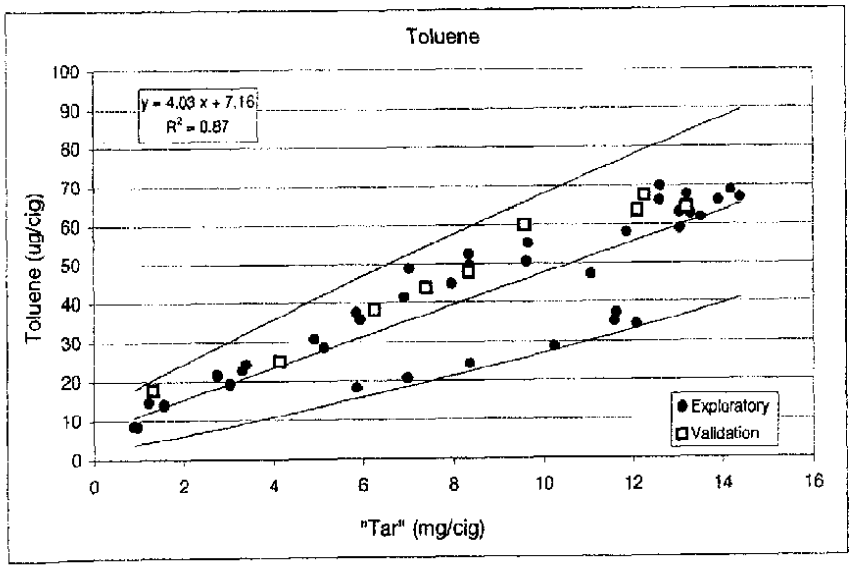






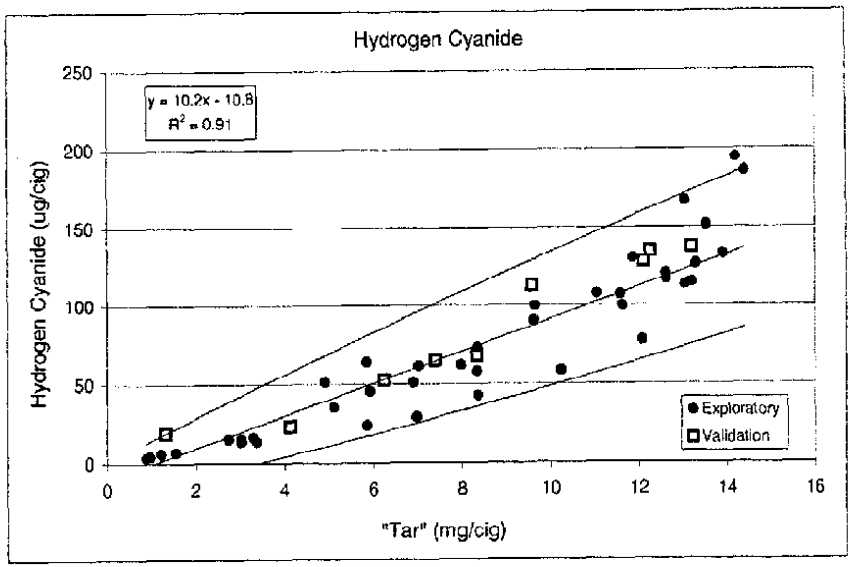
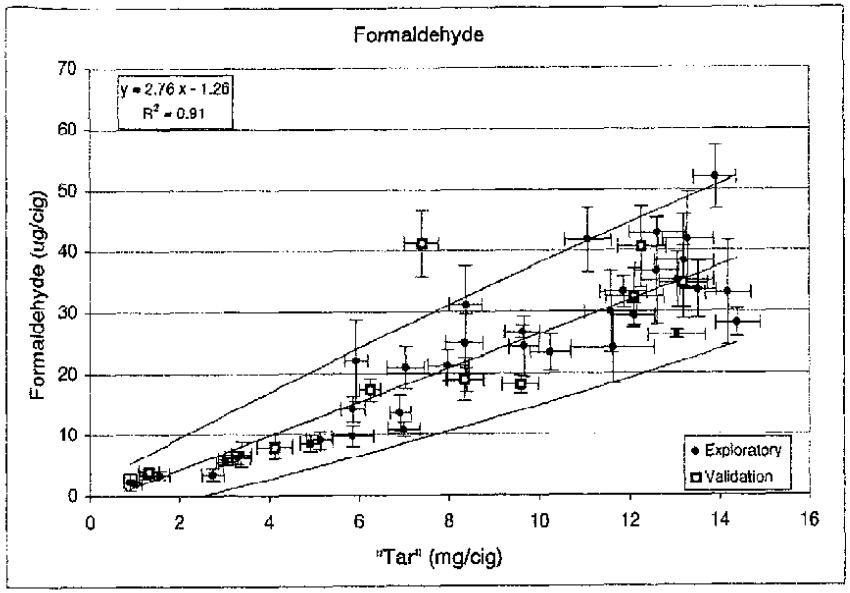
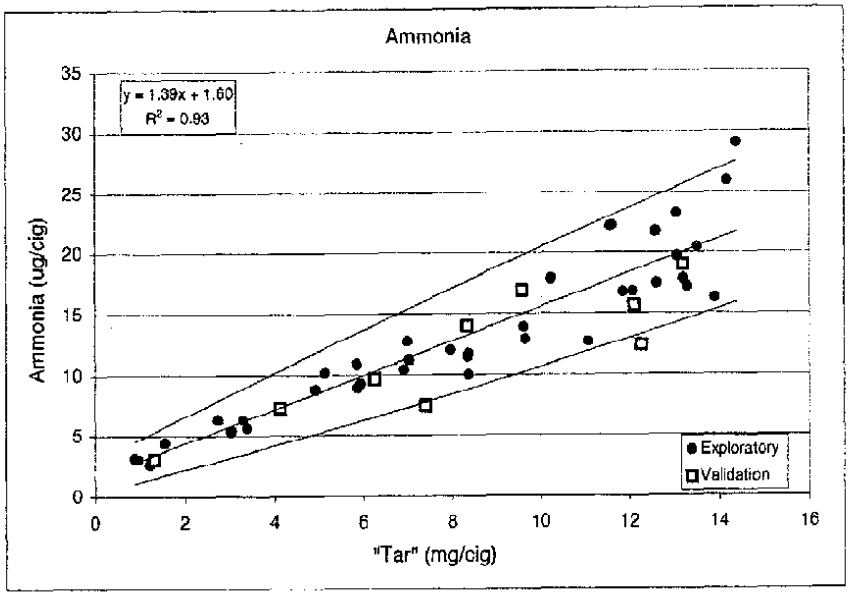
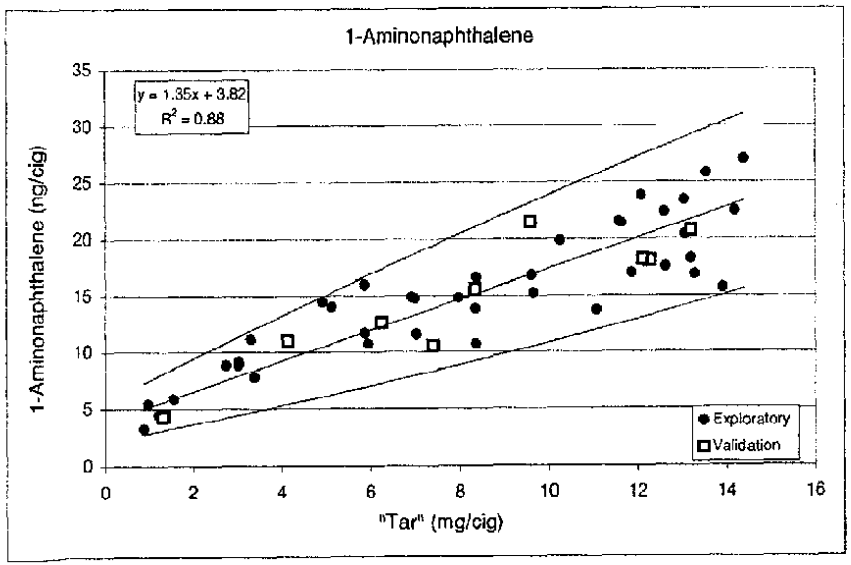


Figure 1: Regression Plots from Weighted Linear Regression with 1/'tar' Weighting







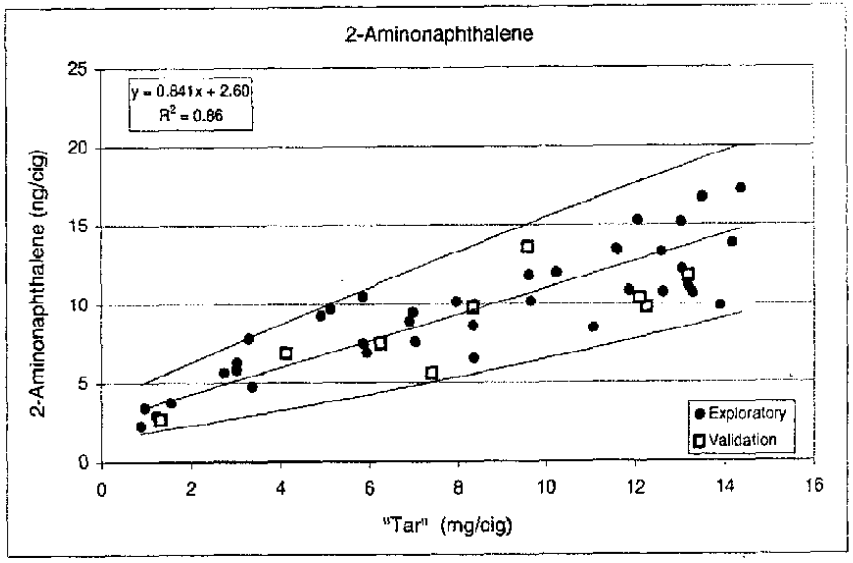
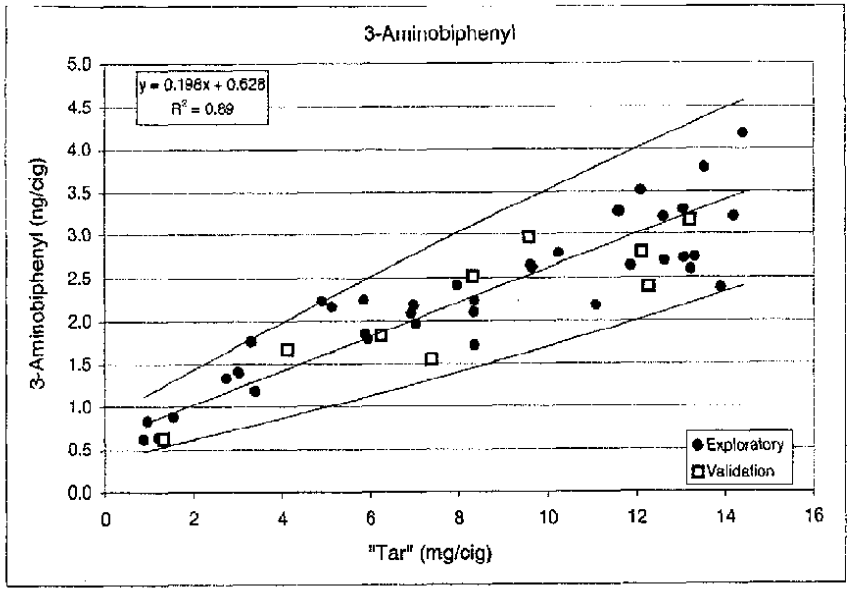
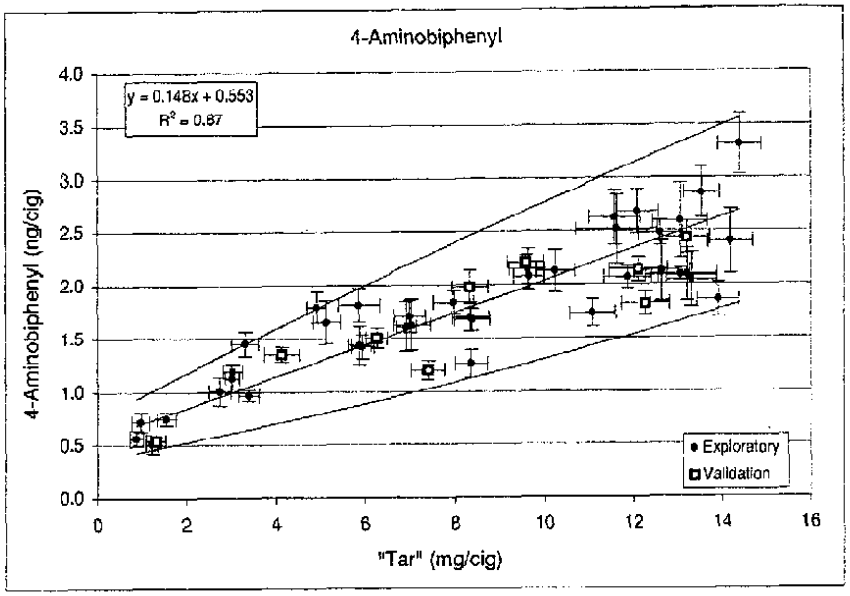
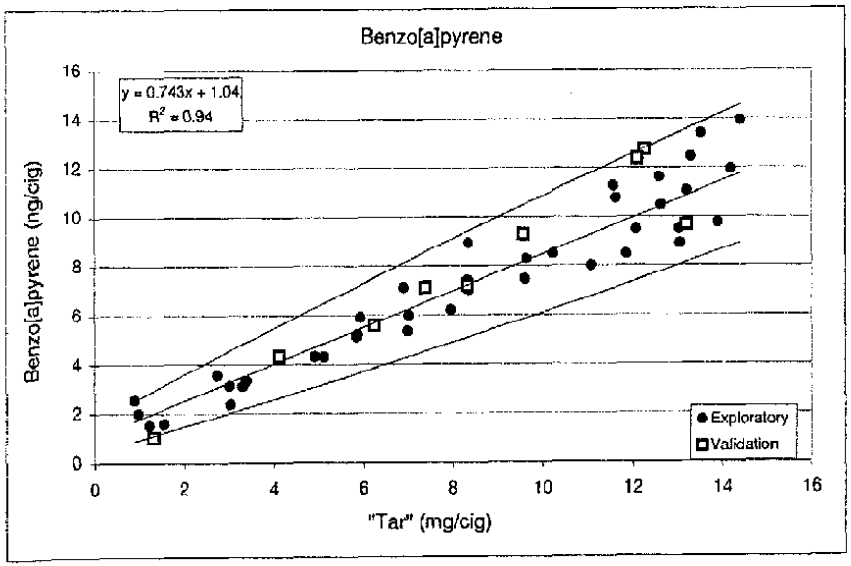


Figure 1: Regression Plots from Weighted Linear Regression with 1/"tar" Weighting







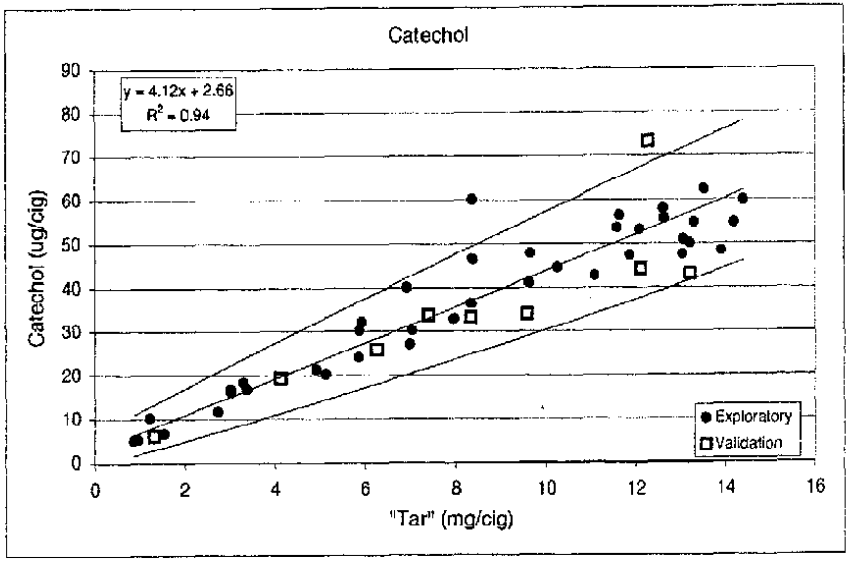
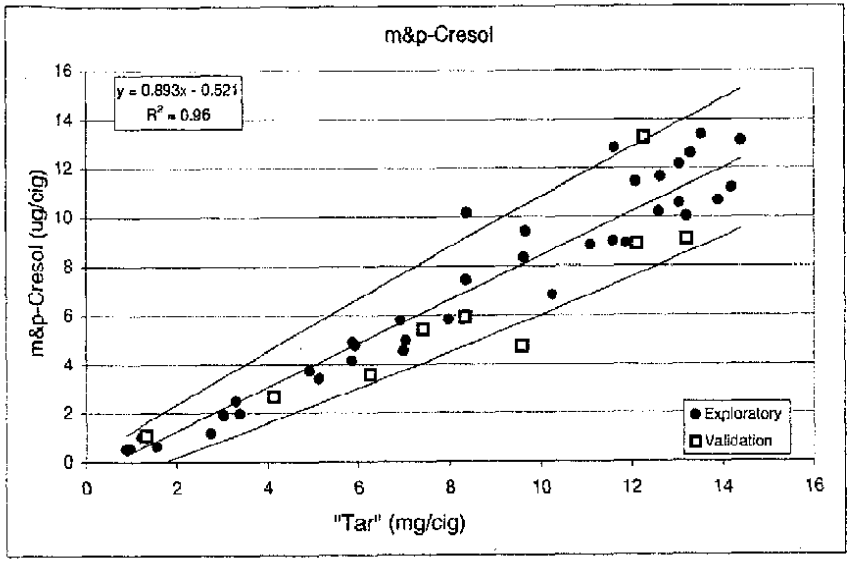
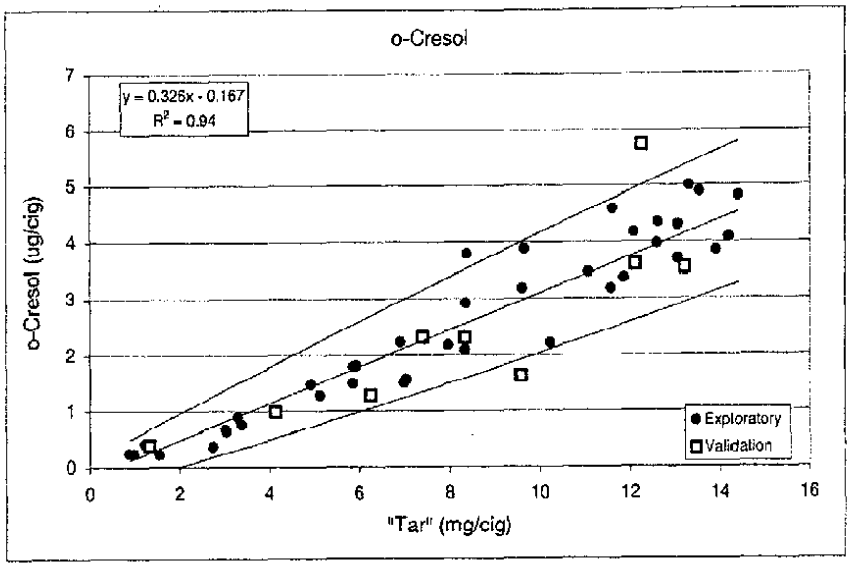
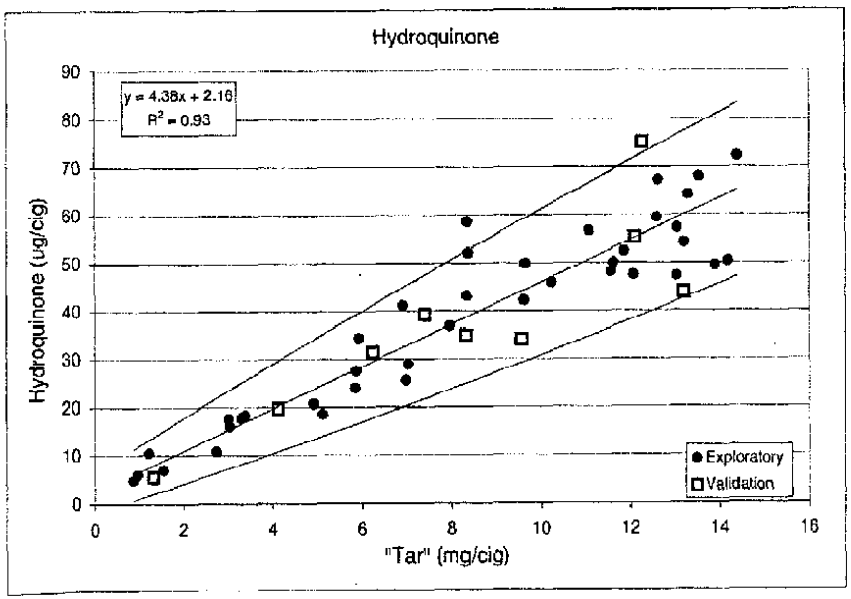


Figure 1: Regression Plots from Weighted Linear Regression with 1/"tar" Weighting







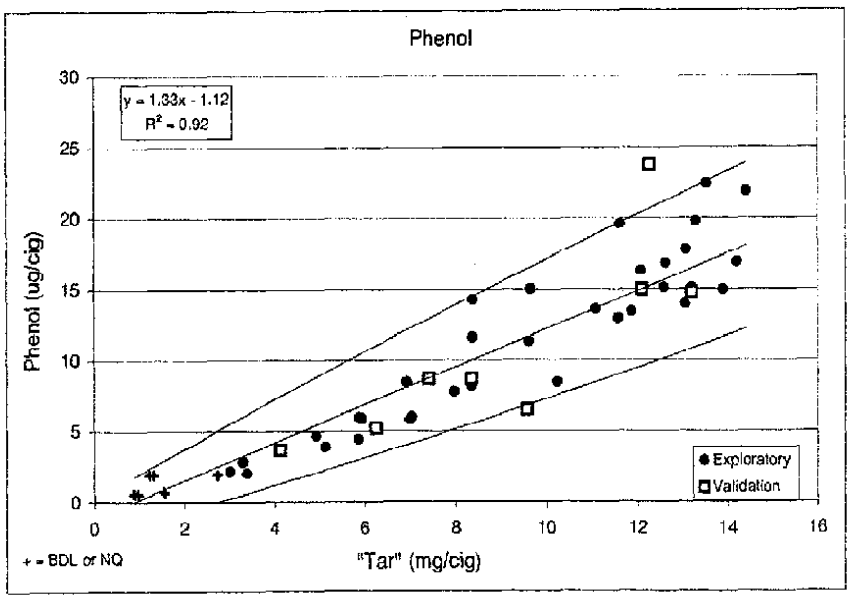
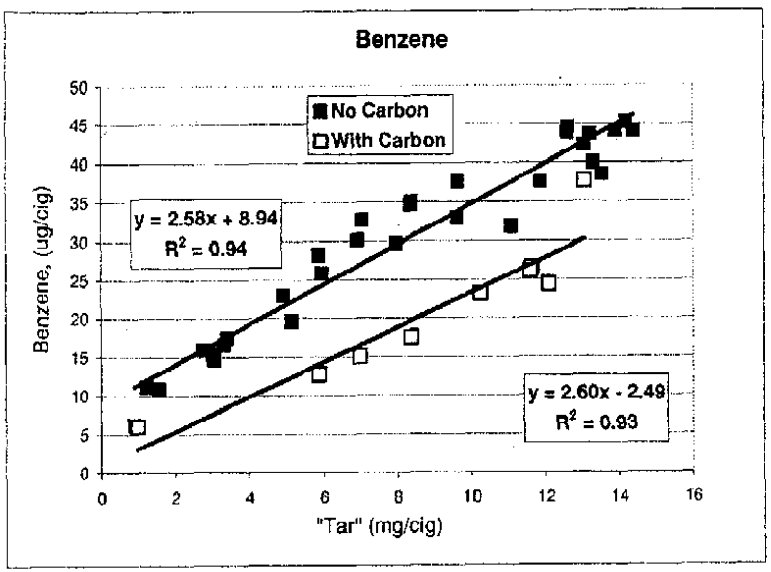


Figure 2: Example Partitioning of Smoke Yields for Carbon Filter Design in Exploratory Brands



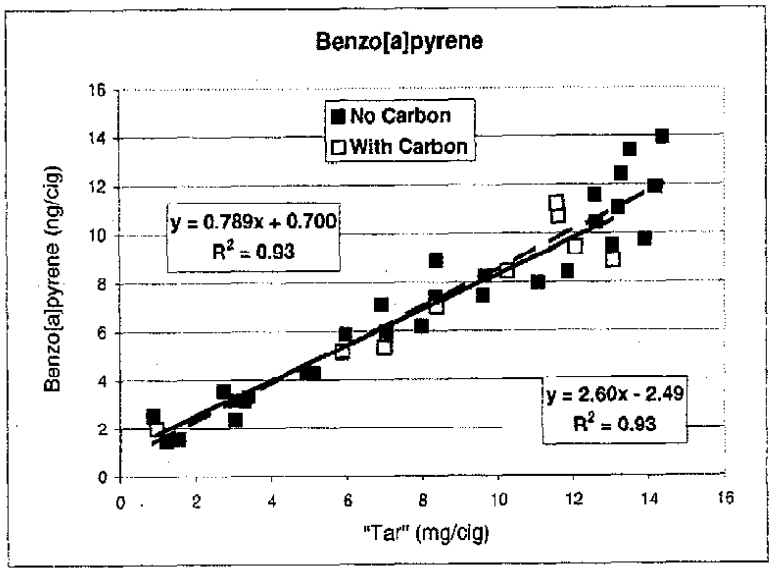


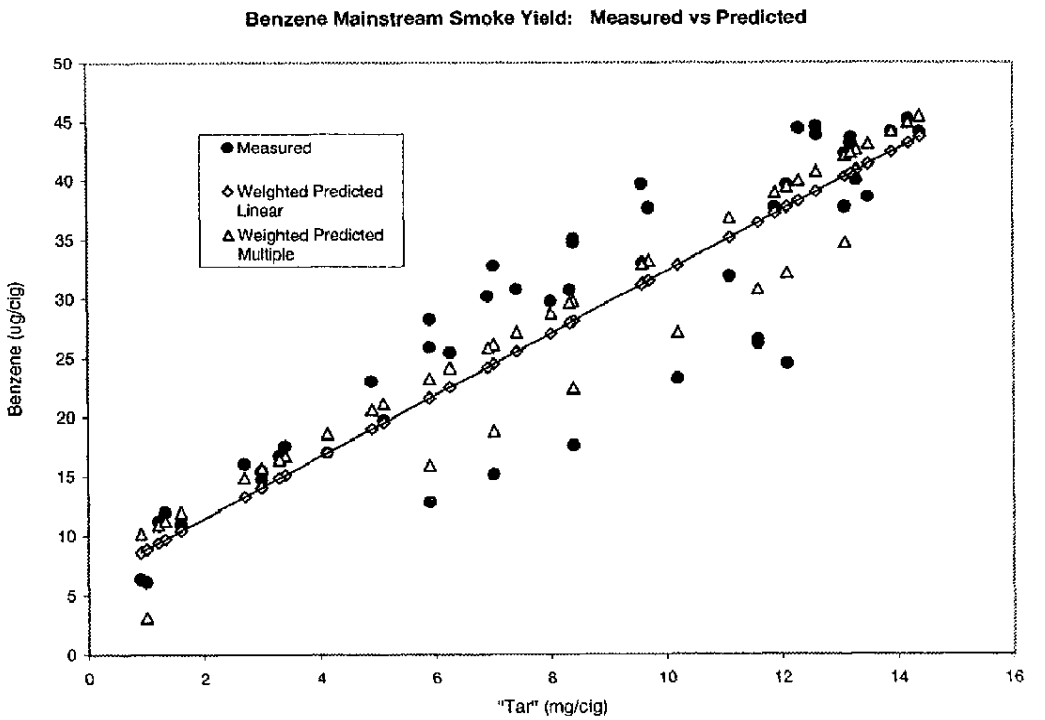
Table 7: Weighted Regression Statistics for Vapor Phase Smoke Constituents with "Tar" and Carbon Factor

Multiple is Regresson with X1 variable = ISO "tar" yield per cigarette and X2 variable = Dummy variable for carbon-in-filter

Linear is Regresson with X variable = SO "tar" yield per cigarette

Smoke Constituent	Wighted Multiple Linear (1/tar) with X1 and X2			Wighted Simple Linear (1/tar) with X1		
	R^2	RMSE	PRESS	R^2	RMSE	PRESS
acetaldehyde	0.97	15.4	14689	0.96	16.6	11852
acetone	0.95	9.2	6051	0.93	10.6	4799
acrolein	0.95	1.8	250	0.93	2.11	181
butyraldehyde	0.94	1.3	162	0.91	1.53	96
crotonaldehyde	0.82	1.2	136	0.80	1.3	66
methyl ethyl ketone	0.93	2.7	621	0.89	3.2	417
propionaldehyde	0.95	1.7	219	0.94	1.9	155
acrylonitrile	0.94	0.4	10	0.92	0.4	7
benzene	0.93	1.4	163	0.86	2.0	173
1,3-butadiene	0.96	1.2	70	0.95	1.4	88
isoprene	0.93	13.3	9129	0.91	15.8	10270
styrene	0.86	0.5	22	0.80	0.6	14
toluene	0.93	2.3	469	0.87	3.1	393
hyrdrogen cyanide	0.92	6.2	2835	0.91	6.5	1730
mercury	0.95	0.1	0	0.91	0.1	0.4

Figure 3: Multiple Regression Examples with "Tar" and Carbon Factor



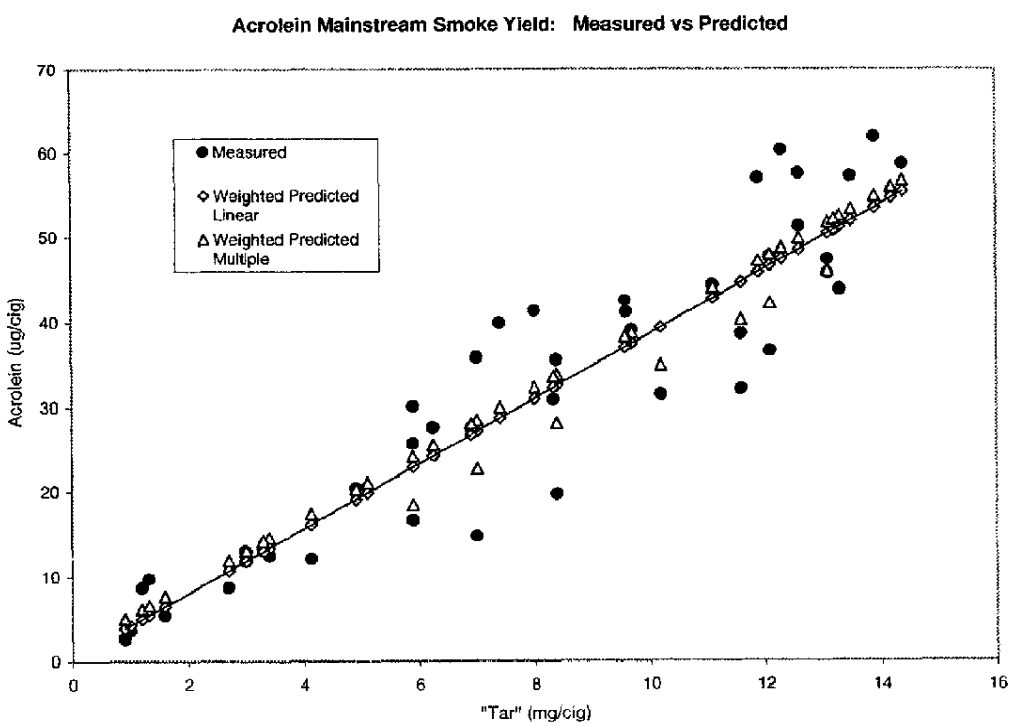


Table 8: Averaged Constituent Yields in Tobacco Filler

Sample Code	Nitrate (mg/g)		NNN (ng/g)		NNK (ng/g)		NAB (ng/g)		NAT (ng/g)	
Exploratory	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
E1	7.84	1.09	1110	102	NQ	NQ	155	29	914.0	50.1
E2	8.71	1.26	2220	123	399.9	29.0	254	13	1646	76
E3	8.89	0.72	3736	243	1124	196	379	70	2945	145
E4	7.49	0.82	1188	168	NQ	NQ	194	39	895.0	94.6
E5	9.83	1.07	2780	81	709.1	47.7	322	37	2106	105
E6	10.9	2.6	2736	38	860.3	154.3	262	21	2253	232
E7	9.27	0.26	1866	25	812.4	46.0	357	37	1559	44
E8	10.9	1.3	2354	118	1058	39	320	35	1786	126
E9	7.75	0.30	1273	47	NQ	NQ	221	19	1082	47
E10	8.98	0.52	2170	307	591.0	94.6	244	58	1339	129
E11	10.6	0.8	3769	84	1194	34	195	18	2883	90
E12	4.10	0.20	331.5	35.4	NQ	NQ	NQ	NQ	423.1	37.8
E13	11.3	1.5	3892	281	1171	123	213	15	3139	210
E14	5.69	0.67	1355	81	445.3	23.7	NQ	NQ	1142	49
E15	9.59	0.16	2520	132	1060	82	156	9	1942	47
E16	9.45	0.11	3149	212	1165	48	172	33	2392	160
E17	10.5	1.1	2722	91	1116	105	188	7	2073	135
E18	8.26	1.16	2012	200	714.8	27.6	NQ	NQ	1562	187
E19	5.78	0.82	1361	61	469.0	56.5	NQ	NQ	1207	176
E20	7.67	0.64	868.0	71.7	NQ	NQ	NQ	NQ	777.7	64.3
E21	10.5	1.4	3739	290	1127	49	255	12	2989	161
E22	6.75	0.56	919.2	160.4	427.2	44.1	NQ	NQ	889.8	139.6
E23	5.49	0.81	996.4	79.0	423.1	59.9	NQ	NQ	958.8	61.0
E24	10.9	0.7	3302	38	1147	45	212	6	2477	78
E25	5.57	1.39	1094	37	NQ	NQ	NQ	NQ	1014	34
E26	11.3	0.9	3438	142	1270	17	116	37	2676	53
E27	5.70	0.84	1216	76	474.4	40.4	NQ	NQ	1092	30
E28	12.6	1.2	3350	159	922.8	87.6	176	12	2170	162
E29	10.4	1.1	2888	237	1193	68	207	8	2368	148
E30	9.14	0.16	2524	271	756.7	52.3	138	8	2171	100
E31	4.95	0.24	420.1	34.2	489.6	75.1	NQ	NQ	715.4	54.3
E32	6.86	0.20	1901	307	453.2	18.2	NQ	NQ	1482	238
E33	8.53	0.46	2353	189	811.0	58.0	150	17	2015	141
E34	7.01	0.36	1365	24	405.8	70.6	NQ	NQ	1060	15
E35	8.95	1.65	1430	187	675.0	29.3	NQ	NQ	1148	114
E36	10.6	0.8	3105	48	1189	185	186	18	2339	36
E37	7.09	1.22	1619	84	486.3	35.7	NQ	NQ	1425	46
E38	9.72	0.30	2223	192	433.5	18.9	NQ	NQ	1302	25
E39	8.77	0.32	1922	401	480.6	57.2	NQ	NQ	1609	254
Validation										
V1	7.88	0.65	3583	78	1042	153	215	19	2763	111
V2	8.12	0.81	320.6	36.1	382.4	46.5	NQ	NQ	494.8	29.4
V3	6.06	0.81	1012	47	NQ	NQ	NQ	NQ	843.1	45.7
V4	8.32	1.26	2101	173	885.5	134.3	165	11	1714	93
V5	10.5	1.0	3938	275	1249	198	227	35	3102	132
V6	10.6	0.2	2360	185	1009	161	150	16	1784	127
V7	4.50	0.40	376.1	61.0	398.7	66.0	NQ	NQ	601.2	18.2
V8	7.00	0.49	1778	72	580.5	57.8	NQ	NQ	1244	56
V9	6.98	0.66	1171	151	358.1	41.0	158	31	911.7	113.3
Reference										
R1	15.4	0.4	2433	268	973.2	35.9	177	33	1942	227
R2	16.2	1.4	2197	96	1020	72	173	25	1844	8

(1) BDL = below the detection limit, NQ = below the limit for quantitation

(2) Limits of quantitation (LOQ) for tobacco specific nitrosamines in tobacco: NNK LOQ = 272 ng/g, NAB LOQ = 103 ng/g, NAT LOQ = 213 ng/g

Figure 4: Prediction Models for ISO Mainstream Tobacco Specific Nitrosamine Yields

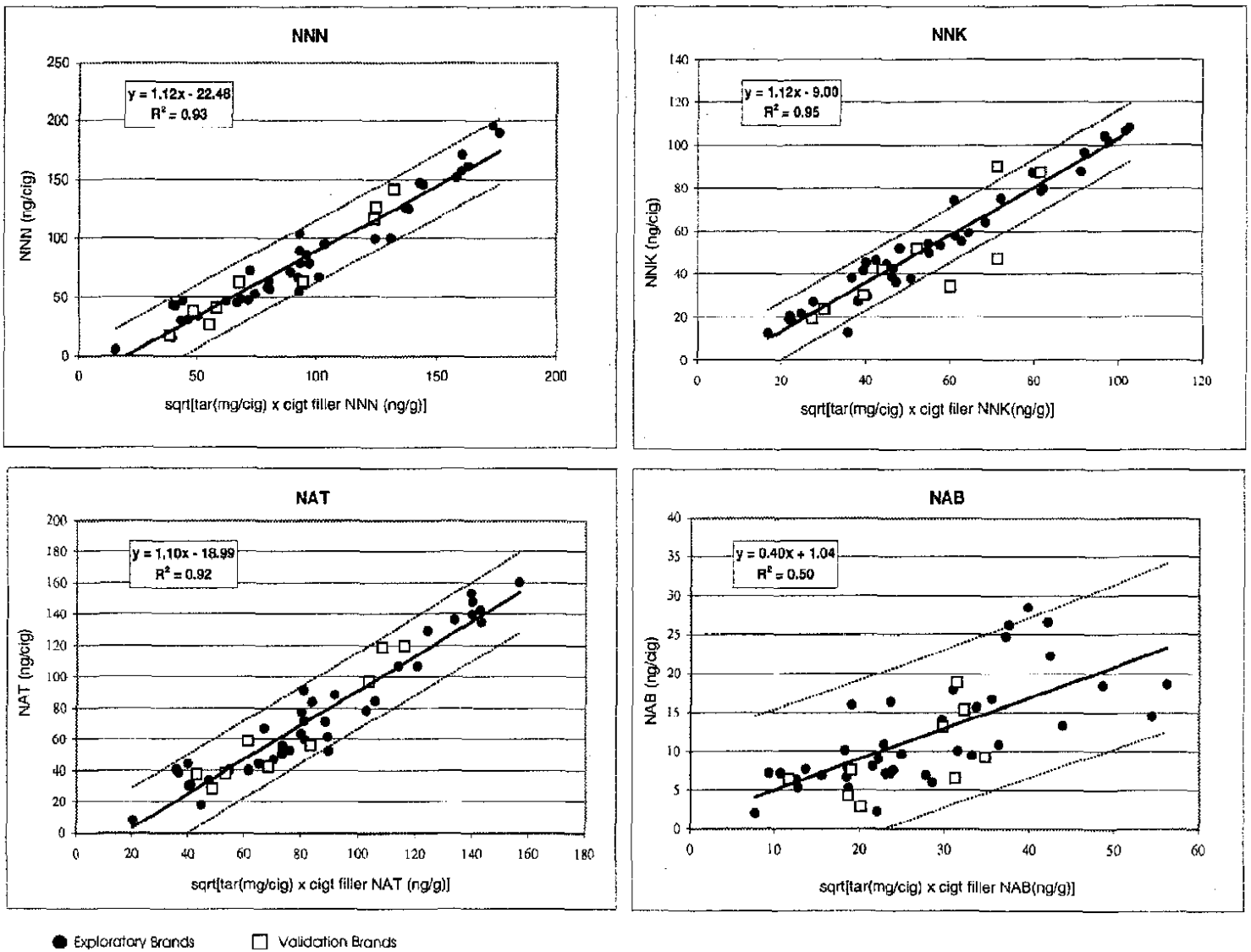


Figure 5: Prediction Models for ISO Mainstream Nitrogen Oxides Yields

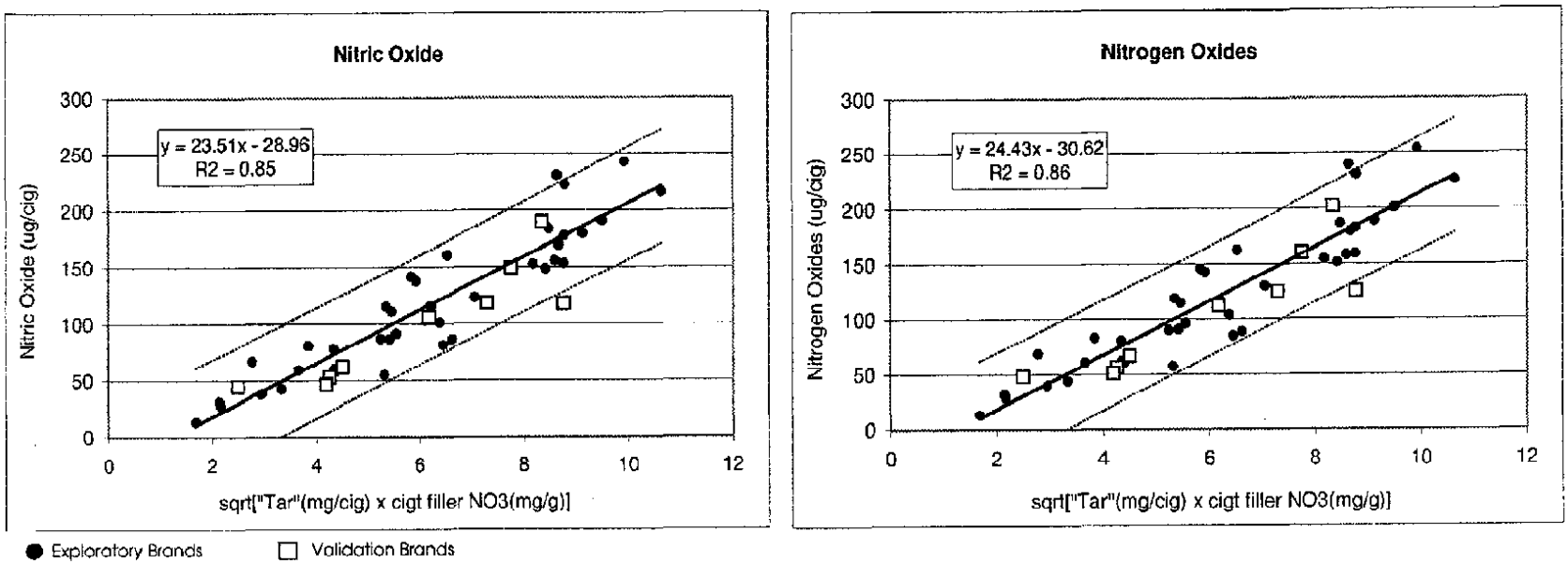


Table 9: Average Measured Yield Coefficient of Variation (%CV) and Absolute Relative Prediction Errors (ARPE) for Validation Br

Smoke Constituent	Average % CV [2]	Average ARPE[1]		
		Linear with tar (weighted)	Multiple: tar and carbon factor (weighted)	Linear with (tar x Filler NO_3)$^{0.5}$
acetaldehyde	10%	16%	15%	
acetone	8%	12%	11%	
acrolein	11%	18%	17%	
butyraldehyde	11%	17%	15%	
crotonaldehyde	13%	25%	25%	
methyl ethyl ketone	9%	17%	15%	
propionaldehyde	9%	14%	13%	
acrylonitrile	7%	22%	19%	
benzene	5%	11%	7%	
1,3-butadiene	6%	16%	13%	
isoprene	6%	13%	10%	
styrene	13%	22%	16%	
toluene	6%	15%	10%	
hydrogen cyanide	9%	21%	21%	
mercury	9%	22%	19%	
nitric oxide	11%	na		26%
nitrogen oxides	10%	na		24%

Smoke Constituent	Average % CV [2]	Average ARPE[1]	
		Linear with tar (weighted)	Linear with (tar x Filler TSNA)$^{0.5}$
formaldehyde	15%	22%	
ammonia	8%	19%	
1-aminonaphthalene	14%	15%	
2-aminonaphthalene	12%	23%	
3-aminobiphenyl	8%	17%	
4-aminobiphenyl	6%	17%	
benzo[a]pyrene	9%	20%	
catechol	7%	18%	
m & p-cresol	7%	29%	
o-cresol	8%	27%	
hydroquinone	7%	19%	
phenol	8%	22%	
resorcinol	7%	10%	
pyridine	14%	21%	
quinoline	9%	23%	
NNN	11%	na	17%
NNK	14%	na	21%
NAT	8%	na	17%
NAB	16%	na	60%
cadmium	10%	21%	
lead	21%	15%	

*(1) absolute relative prediction error = ((absolute prediction error)/measured yield)*100*

*(2) %CV = (measured yield standard deviation/mean measured yield)*100*

PM3006878348

Table 10: Variability of Analytical Methods with Time in the Analysis of 1R4F

Labstat Study # 1R4F	Units	N	Sep-00		Oct-00		Mar-01		May-01		Jul-01		Means	SEM	95% CI		95% CI % of Means
Replicates			mean	sd	mean	sd	mean	sd	mean	sd	mean	sd			Upper	Lower	
"Tar"	mg/cig	20	9.58	0.42	8.67	0.34	9.14	0.36	8.92	0.37	9.18	0.31	9.10	0.34	9.76	8.44	7.2%
nicotine	mg/cig	20	0.77	0.03	0.73	0.03	0.73	0.04	0.77	0.07	0.76	0.03	0.75	0.02	0.79	0.72	4.9%
carbon monoxide	mg/cig	20	12.04	0.75	11.6	0.3	11.6	0.6	12.2	0.5	12.0	0.8	11.88	0.29	12.45	11.30	4.9%
water	mg/cig	20	0.797	0.210	0.822	0.097	0.671	0.134	0.839	0.195	0.910	0.220	0.808	0.087	0.979	0.637	21%
MS TPM	mg/cig	20	11.1	0.6	10.2	0.3	10.5	0.5	10.5	0.4	10.9	0.4	10.66	0.34	11.34	9.99	6.3%
cigarette weight	mg/cig	20	1070	10	1061	12	1065	11	1065	12	1078	9	1068	6	1079	1057	1.0%
puff count	#/cig	20	8.67	0.27	8.27	0.28	8.58	0.26	8.31	0.25	8.69	0.18	8.50	0.20	8.89	8.12	4.5%
acetaldehyde	ug/cig	7	588	47	612	43	574	57	518	43	505	61	560	46	649	470	16%
acetone	ug/cig	7	291	23	288	17	312	22	262	21	305	35	296	13	320	271	8.4%
acrolein	ug/cig	7	50.0	4.6	46.1	4.1	46.3	4.8	38.5	3.4	53.9	8.4	47.0	5.7	58.1	35.8	24%
butyraldehyde	ug/cig	7	29.5	2.9	29.6	1.2	38.6	3.8	36.1	5.5	35.3	4.5	33.8	4.2	42.0	25.7	24%
crotonaldehyde	ug/cig	7	12.0	0.8	13.0	1.0	14.9	1.5	15.4	1.5	14.0	2.8	13.9	1.4	16.6	11.1	20%
methyl ethyl ketone	ug/cig	7	55.9	2.8	57.3	2.9	75.0	6.4	63.8	5.4	74.0	6.8	65.2	9.0	82.8	47.6	27%
propionaldeyde	ug/cig	7	49.3	2.7	50.6	2.8	55.9	5.6	48.1	3.8	46.3	5.4	50.1	3.6	57.2	42.9	14%
acrylonitrile	ug/cig	7	9.06	0.88	7.76	1.11	8.30	0.80	9.16	0.53	10.10	0.90	8.88	0.89	10.6	7.1	20%
benzene	ug/cig	7	42.1	2.5	32.4	2.8	40.5	2.6	37.3	3.1	42.2	2.3	38.9	4.1	47.0	30.8	21%
1,3-butadiene	ug/cig	7	45.7	3.2	33.7	1.7	42.8	3.3	39.0	2.3	38.7	1.5	40.0	4.6	48.9	31.0	22%
isoprene	ug/cig	7	356	21	306	16	397	19	342	27	394	18	359	38	433	285	21%
styrene	ug/cig	7	7.17	0.65	6.51	0.56	7.10	0.22	7.75	0.33	6.79	0.45	7.06	0.46	7.97	6.16	13%
toluene	ug/cig	7	67.9	4.7	55.7	4.8	65.2	5.0	61.2	5.4	69.5	4.7	63.9	5.5	74.8	53.0	17%
hydrogen cyanide	ug/cig	7	129	11	125	4	130	10	121	11	109	10	123	9	140	106	14%
nitric oxide	ug/cig	7	297	18	282	30	317	21	283	25	294	30	295	14	323	267	9.4%
nitrogen oxides	ug/cig	7	311	19	291	32	331	22	296	25	312	37	308	16	340	277	10%
mercury	ng/cig	7	5.32	0.87	5.82	0.46	5.17	0.40	6.27	0.33	4.98	0.37	5.51	0.53	6.54	4.48	19%
formaldehyde	ug/cig	7	22.6	1.4	18.0	2.3	26.4	7.3	19.3	1.8	17.9	3.0	20.8	3.7	28.0	13.7	34%
ammonia	ug/cig	7	13.8	1.4	12.6	1.0	13.4	0.5	14.1	1.0	12.9	1.0	13.4	0.6	14.6	12.1	9.4%
1-aminonaphthalene	ng/cig	7	18.5	5.5	14.2	0.5	20.0	4.5	18.4	1.4	16.7	0.9	17.6	2.2	21.9	13.2	25%
2-aminonaphthalene	ng/cig	7	11.9	2.3	10.1	1.0	11.9	2.3	11.7	0.5	10.9	0.5	11.3	0.8	12.8	9.8	13%
3-aminobiphenyl	ng/cig	7	2.96	0.27	2.54	0.19	2.97	0.45	3.08	0.20	2.77	0.27	2.86	0.21	3.28	2.45	14%
4-aminobiphenyl	ng/cig	7	2.13	0.23	2.01	0.13	2.30	0.36	2.33	0.17	2.10	0.11	2.17	0.14	2.44	1.91	12%
benzo[a]pyrene	ng/cig	7	6.85	0.57	6.56	0.43	7.33	1.39	6.74	0.70	7.26	0.84	6.95	0.33	7.60	6.29	9.4%
catechol	ug/cig	7	34.8	3.4	39.8	1.9	40.9	2.0	34.3	0.8	38.2	1.2	37.6	3.0	43.4	31.8	15%
m & p-cresols	ug/cig	7	8.34	0.93	8.23	0.73	8.43	0.42	7.03	0.39	7.01	0.68	7.81	0.72	9.22	6.39	18%
o-cresol	ug/cig	7	3.54	0.34	3.27	0.15	3.50	0.29	2.88	0.15	2.81	0.38	3.20	0.34	3.87	2.53	21%
hydroquinone	ug/cig	7	41.4	5.8	44.7	2.1	39.2	1.9	37.9	2.3	38.1	0.9	40.3	2.9	45.9	34.7	14%
phenol	ug/cig	7	12.1	2.1	10.9	0.7	11.3	0.5	9.66	0.80	8.02	0.51	10.4	1.6	13.5	7.3	30%
resorcinol	ug/cig	7	0.49	0.03	NQ		0.857	0.076	0.806	0.035	NQ		0.72	0.20	1.11	0.32	55%
pyridine	ug/cig	7	6.88	0.31	7.79	0.39	8.02	0.36	8.55	0.55	6.70	0.48	7.59	0.78	9.12	6.06	20%
quinoline	ug/cig	7	0.303	0.024	0.323	0.052	0.283	0.021	0.304	0.018	0.262	0.016	0.30	0.02	0.34	0.25	15%
NNN	ng/cig	7	142.0	15.4	110.0	3.9	107	4	109	13	109	2	115.4	14.9	145	86	25%
NNK	ng/cig	7	119.8	15.2	86.2	12.2	75.6	8.5	87.7	12.4	89.1	8.8	91.7	16.6	124	59	35%
NAT	ng/cig	7	160.2	15.0	127.0	2.6	118	6	127	11	130	6	132	16	164	101	24%
NAB	ng/cig	7	37.2	8.6	24.1	2.9	25.3	3.1	21.8	2.1	20.2	2.2	25.7	6.7	38.9	12.6	51%
cadmium	ng/cig	7	62.8	3.0	66.0	4.8	68.7	1.7	62.2	4.6	62.3	4.9	64.4	2.9	70.0	58.8	8.8%
lead	ng/cig	7	35.5	1.9	36.9	2.7	39.2	1.9	35.6	2.9	36.3	1.9	36.7	1.5	39.6	33.7	8.0%
chromium	ng/cig	7	10.2	7.7	n/a		BDL		BDL		BDL		10.2				
nickel	ng/cig	7	6.79	3.31	n/a		BDL		BDL		BDL		6.79				
arsenic	ng/cig	7	4.11	3.19	n/a		5.03	0.88	3.94	0.25	5.63	0.81	4.68	0.80	6.24	3.12	33.4%
selenium	ng/cig	7	BDL		n/a		BDL		BDL		BDL		BDL		BDL		
Smoke pH		7	6.1	0.1	6.1	0.1	5.92	0.04	5.97	0.10	5.99	0.05	6.01	0.08	6.17	5.86	2.8%

revised 12-17-02

Table 11: Mainstream Smoke Constituent Yields for a Commercial Brand Over a Nine-month Period

Analysis		Avg of Means	Std Error (SD of Means)	95% Confidence Interval Lower	95% Confidence Interval Upper	+/- 95% CI % of Mean
"tar"	mg/cig	6.1	0.2	5.8	6.5	6%
nicotine	mg/cig	0.53	0.01	0.51	0.55	4%
carbon Monoxide	mg/cig	7.4	0.4	6.7	8.1	10%
acetaldehyde	ug/cig	428	38.4	353	503	18%
acetone	ug/cig	248	24.5	200	296	19%
acrolein	ug/cig	44.9	4.7	35.7	54.2	21%
butyraldehyde	ug/cig	30.5	3.5	23.8	37.3	22%
crotonaldehyde	ug/cig	9.8	1.9	6.1	13.5	38%
methyl ethyl ketone	ug/cig	52.3	4.7	43.1	61.6	18%
propionaldeyde	ug/cig	34.6	3.5	27.9	41.4	20%
acrylonitrile	ug/cig	8.5	2.3	4.0	13.0	53%
benzene	ug/cig	29.7	4.0	21.9	37.4	26%
1,3-butadiene	ug/cig	30.1	3.3	23.6	36.6	22%
isoprene	ug/cig	272	30	212	331	22%
styrene (vapor phase)	ug/cig	1.98	0.64	0.7	3.2	63%
toluene	ug/cig	39.4	8.5	22.8	56.0	42%
formaldehyde	ug/cig	9.6	2.1	5.6	13.6	42%
benzo[a]pyrene	ng/cig	5.2	0.21	4.8	5.6	8%
benz[a]anthracene	ng/cig	9.5	0.67	8.2	10.9	14%
NNN	ng/cig	87.6	6.8	74.2	101	15%
NNK	ng/cig	65.6	8.5	49.0	82.2	25%
NAT	ng/cig	80.4	5.8	69.0	91.9	14%
NAB	ng/cig	9.5	0.83	7.9	11.1	17%
					Avg for Constituents =	+/- 26%

95% Confidence Interval = average of means +/- 1.96(std error)

Table 12: Comparison of Reported Kentucky Reference 1R4F Cigarette Mainstream Smoke Constituent Yields from Different Laboratories

Refernce		Contract Lab A	Contract Lab B	(Gardner, 2000)	(Chepiga, 2000)	(LGC, 2000b, 2002a, b))	Ratio Max / Min
Smoke Method		ISO	FTC	FTC	FTC	ISO	
"tar"	mg/cig	9.14	10.02		8.70		1.15
nicotine	mg/cig	0.73	0.82		0.78		1.12
carbon monoxide	mg/cig	11.6	13.4		11.0		1.22
acetaldehyde	ug/cig	574	677	640	707		1.23
acetone	ug/cig	312	273	284	284		1.15
acrolein	ug/cig	46.3	65.5	65.0	59.7		1.42
butyraldehyde	ug/cig	38.8	33.3				1.16
crotonaldehyde	ug/cig	14.9	18.9				1.27
methyl ethyl ketone	ug/cig	75.0	95.1				1.27
propionaldehyde	ug/cig	55.9	57.0				1.02
acrylonitrile	ug/cig	8.30	10.7	13.9		14.2 ('02b)	1.71
benzene	ug/cig	40.5	47.8	44.2		27.3 ('02b)	1.75
1,3-butadiene	ug/cig	42.8	40.6	36.5		50.5 ('02b)	1.38
isoprene	ug/cig	397	418	366		225 ('02b)	1.85
styrene	ug/cig	7.10	7.35			0.76 ('02b)	9.67
toluene	ug/cig	65.2	89.1	73.3		37.96 ('02b)	2.34
hydrogen cyanide	ug/cig	130	122	165	144		1.35
nitric oxide	ug/cig	317	254			311 ('00b)	1.25
nitrogen oxides	ug/cig	331		258	266		1.28
mercury	ug/cig	5.17	4.61				1.12
formaldehyde	ug/cig	26.4	22.0	8.50	12.5		3.11
ammonia	ug/cig	13.4	11.9	16	18.8		1.58
1-aminonaphthalene	ng/cig	20.0	10.2				1.95
2-aminonaphthalene	ng/cig	11.9	6.59	10.9			1.80
3-aminobiphenyl	ng/cig	2.97	1.80				1.65
4-aminobiphenyl	ng/cig	2.30	1.43	4.0			2.79
benzo[a]pyrene	ng/cig	7.33	4.84	5.40	4.60	7.10 ('02a)	1.59
catechol	ug/cig	40.9	40.6	45.3	43.5		1.12
m & p-cresols	ug/cig	8.43	7.52	7.60	7.20		1.17
o-cresol	ug/cig	3.50	3.04				1.15
hydroquinone	ug/cig	39.2	35.5	42.9	39.8		1.21
phenol	ug/cig	11.3	10.5	8.90	9.60		1.26
resorcinol	ug/cig	0.86	0.48				1.77
pridine	ug/cig	8.02	4.07				1.97
quinoline	ug/cig	0.28	0.21	0.23			1.33
NNN	ng/cig	107	100	115	67.0		1.72
NNK	ng/cig	75.6	85.8	97.0	78.0		1.28
NAT	ng/cig	118	107	126	93.0		1.35
NAB	ng/cig	25.3	18.0				1.41
cadmium	ng/cig	68.7	68.8				1.00
lead	ng/cig	39.2	38.9				1.01
arsenic	ng/cig	4.66	5.96				1.28
						Average (excluding styrene) constituent range % =	1.50